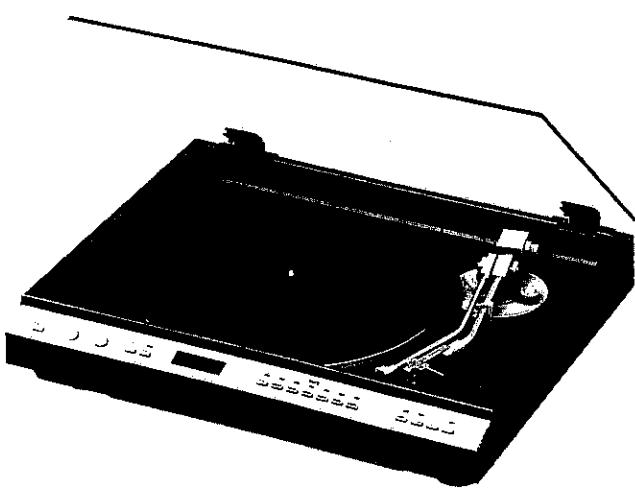




OPTIONICA

# SERVICE MANUAL

RP-7100H  
RP-7100HB



## STEREO TURNTABLE

**MODEL**  
**RP-7100H**  
(Silver Panel)

**RP-7100HB**  
(Brown Panel)

In the interests of user-safety the set should be restored to its original condition and only parts identical to those specified be used.

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## SPECIFICATIONS

Power source:	AC 110/220/240V, 50/60 Hz	Speed:	33-1/3 and 45 rpm
Power consumption:	10W	Speed control range:	Within $\pm 4\%$
Semiconductors:	22-IC	Wow & Flutter:	$\pm 0.045\%$ (DIN 45 507)
	47-transistor	Rumble:	Better than 68 dB (DIN-B)
	33-diode	Turntable platter:	30 cm (12 in.) aluminum die-cast with stroboscope marks.
Dimensions:	2-hall elements		
(with dust cover)	1 quartz-crystal oscillator		
Weight:	Width: 480 mm (18-29/32")		
	Height: 108 mm (4-1/4")		
	Depth: 384 mm (15-1/8")		
	9 kg (20 lbs)		
<b>TURNTABLE</b>			
Motor:	Core-less DC servo mono-torque motor	Type:	Statically balanced pipe arm with APLD sensor.
Speed stabilization:	160-pole frequency generator, PLL with quartz-crystal oscillator, sample hold phase detector.	Effective length:	210 mm (18-1/4")
Drive system:	Direct-drive	Overhang:	11 mm (7/16")
		Off-set angle:	19°
		Cartridge weight range:	4 to 12 grams

Specifications are subject to change without prior notice.

## DESIGNATION OF PARTS

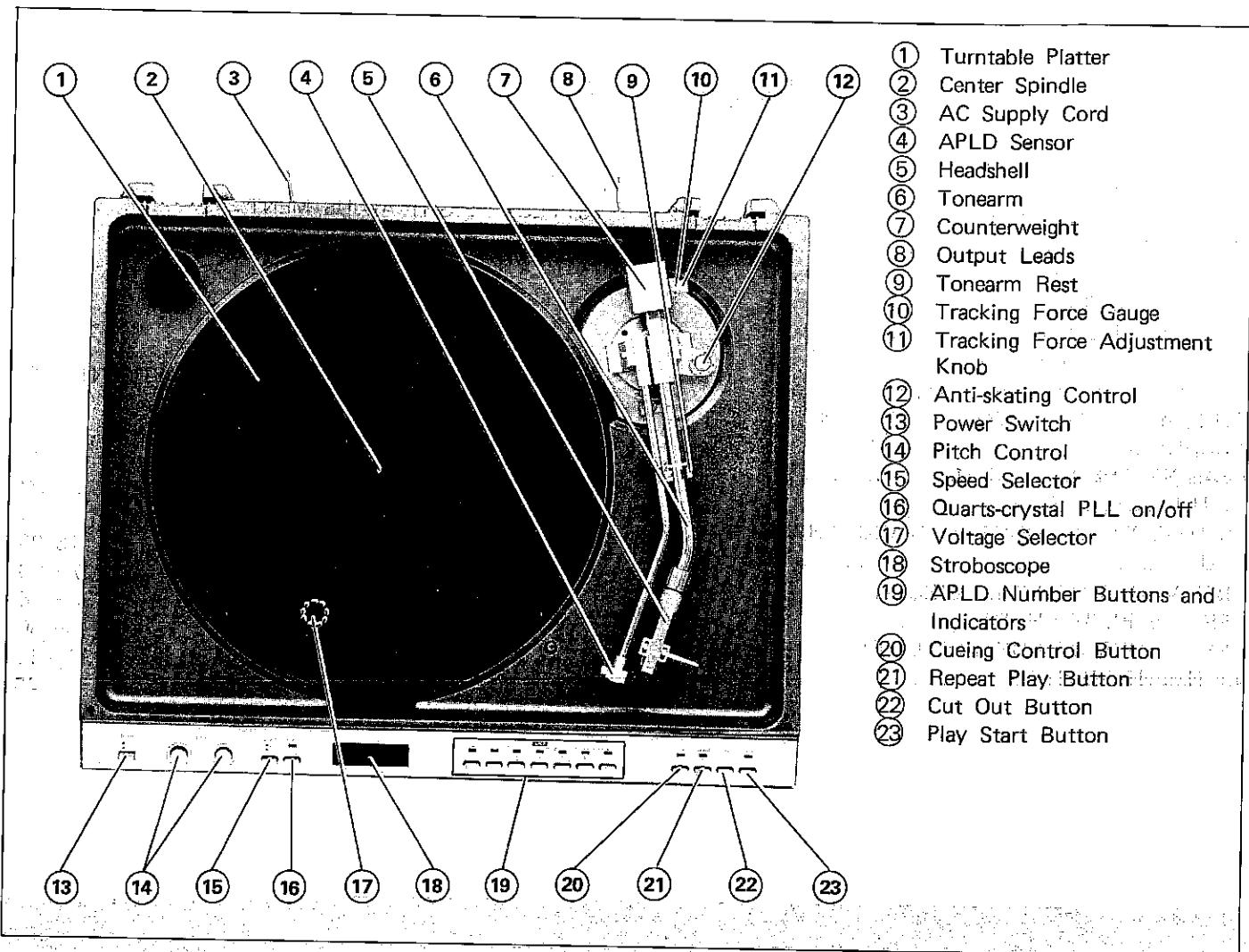


Figure 1

## DISASSEMBLY

Disconnect all leads connected to the back of the unit.  
Remove fourteen (14) screws retaining the bottom plate.

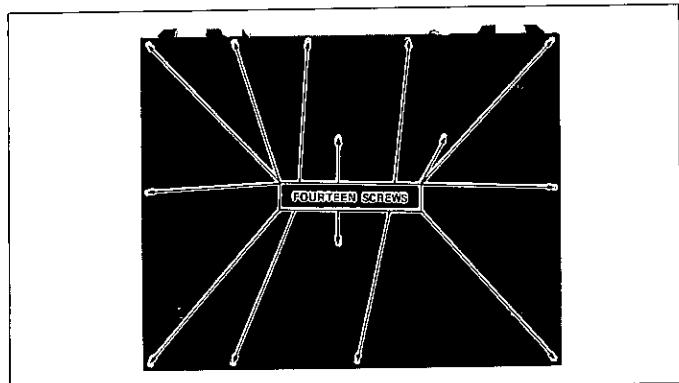


Figure 2

## VOLTAGE SELECTION

Check the preset AC supply voltage before plugging the AC supply cord into an AC wall outlet. If the setting is different from your local supply voltage, the voltage selector (located on the base board, under the turntable platter) must be reset as follows:

Rotate the voltage selector switch with a screwdriver, so that your local voltage number can be seen in the window.

**Note:**

Since this unit uses DD motor, operation is regardless of whether the frequency of AC supply is 50 Hz or 60 Hz.

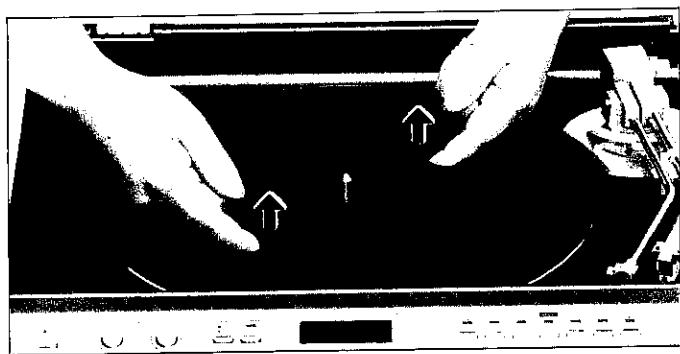


Figure 3

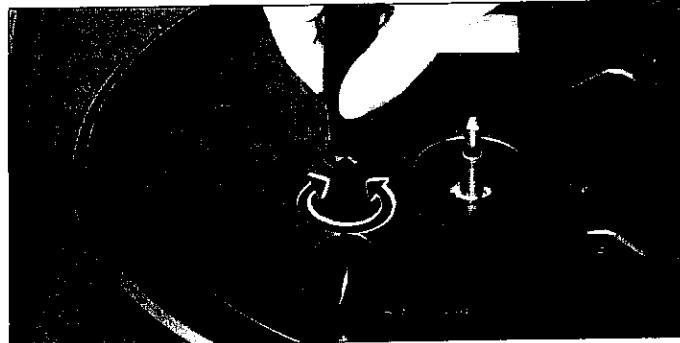


Figure 4

## TONEARM LIFTER

When operating the turntable after it has been stored for long periods, tonearm may not move in initial action because of the property of oil.

In this case, move the tonearm lifter 2 to 3 times up and down with your fingers. The lifter will be able to function normally.

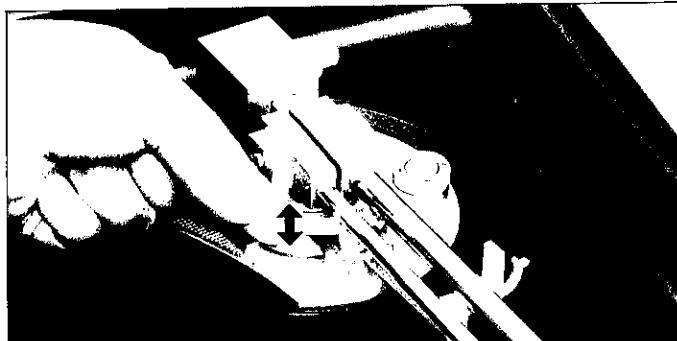


Figure 5

## CARTRIDGE MOUNTING

A cartridge is not furnished with the unit.

### Important Note:

- \* Any cartridge of which the dimension "A" shown in figure 7 is greater than 19 mm, cannot be applied to this set.
- \* The weight of the cartridge should be 4 to 12 grams.

1. Before attempting to mount the cartridge, read the instructions supplied by the cartridge manufacturer. The cartridge you have selected may require some special mounting hardware or need to be insulated from the headshell. The cartridge can be mounted to the headshell with the hardware supplied by the cartridge manufacturer or with the hardware included with the turntable.
2. The headshell has been pre-wired to facilitate connection to the cartridge. Attach the wires to the cartridge by sliding the connector over the proper terminal on the cartridge.
3. The cartridge must be positioned in the headshell so that there is a distance of 50 mm between the tip of the stylus and the rubber grommet at the plug end of the headshell. Without this adjustment the APLD won't function normally.

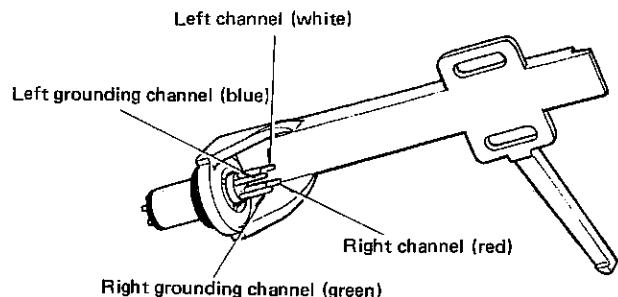


Figure 6

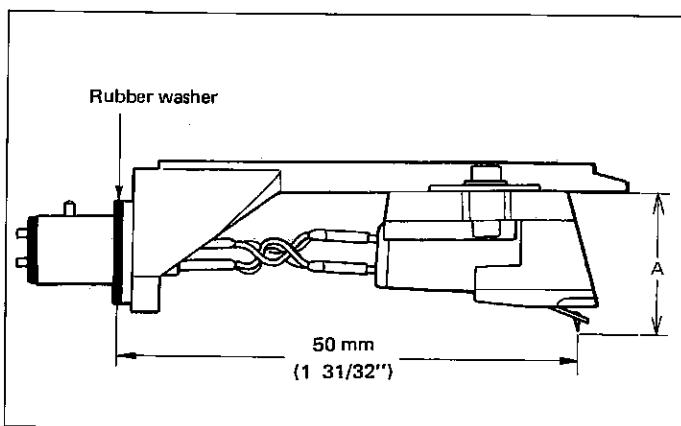


Figure 7

## DUST COVER MOUNTING

Join the plate hinges and hinge brackets on the cabinet with a downward motion as indicated by the arrow in the illustration.

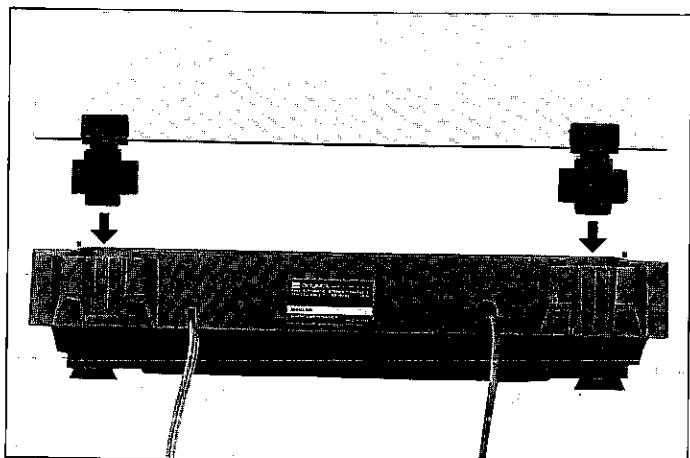


Figure 8

## TRACKING FORCE ADJUSTMENT

1. Adjust the antiskating control to the "0" position (See Figure 9).
2. Move the tonearm to over the platter surface. The tonearm must be supported with your hand to prevent the stylus from hitting the motor board or the platter (See Figure 10).
3. Rotate the tracking force adjustment knob till perfect balance is achieved. When the tonearm is perfectly balanced it will keep its horizontal position when you remove your hand (See Figure 11).
4. Replace the tonearm on the rest with your hand (See Figure 12).
5. Rotate the tracking force gauge with your fingers till "0" graduation aligns with a mark on the counterweight (See Figure 13).
6. Consult the cartridge instructions to find the tracking force recommended by the cartridge manufacturer. Rotate the tracking force adjustment knob in the direction of the arrow as shown in the figure 14, till the desired force aligns to a mark on the counterweight.
7. Adjust the anti-skating control to the same number as the tracking force that you have chosen in the above step 6 (See Figure 15).

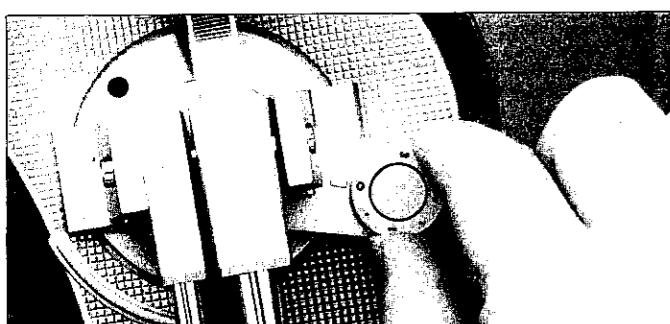


Figure 9

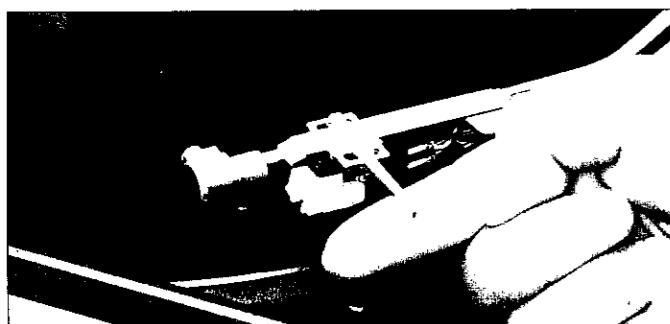


Figure 10

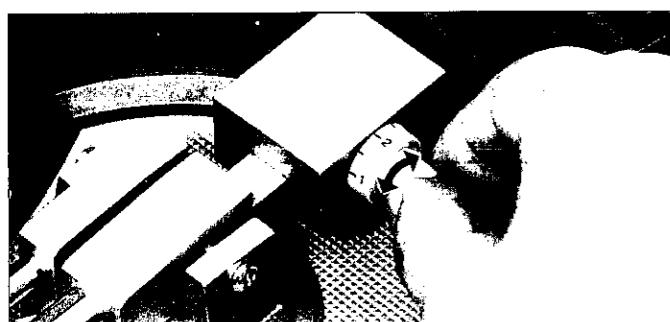


Figure 11

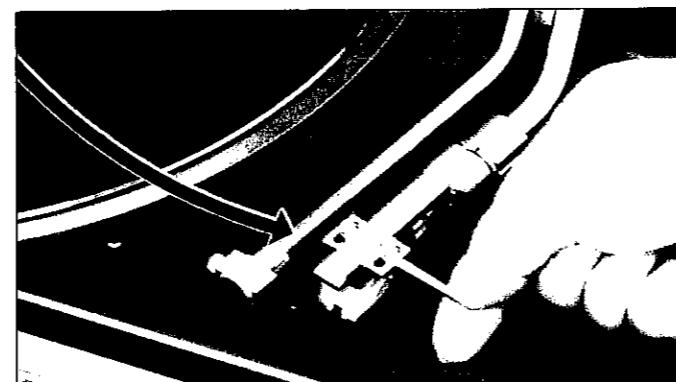


Figure 12

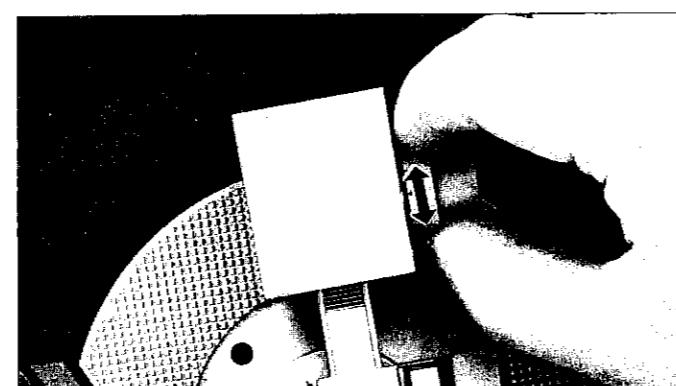


Figure 13

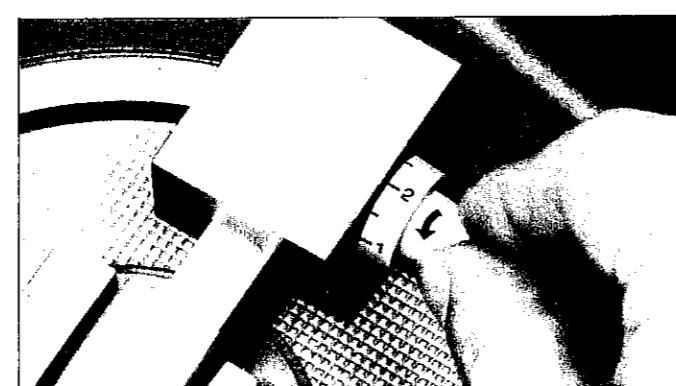


Figure 14



Figure 15

## ADJUSTMENT OF AUTOMATIC LEAD-IN MECHANISM

If the stylus, APLD sensor and tonearm bearing are not positionally arranged at the same center line, this results in both the APLD and autoplay-start mechanism working abnormally. This is proved by the fact that the APLD cannot search for the desired program's spaces in a normal way. In this case, take the following procedures to solve the problem.

1. Keep two discs in hand, a 30 cm (12") and 17 cm (7") one.
2. After adjusting the tracking force of cartridge, plug the AC supply cord into a wall outlet, then set the power switch to "on" position.
3. Place a 30 cm (12") disc on the rubber mat of turntable.
4. Press the "play" button. The tonearm will leave the rest and descend on the disc.
5. If the stylus descends outside the disc periphery, rotate the screw (as shown in the illustration) anticlockwise. While, if it descends inside the starting groove of the disc, rotate the screw clockwise.
6. Next, place a 17 cm (7") disc, instead of the 30 cm (12") one, on the platter and do the same as above.

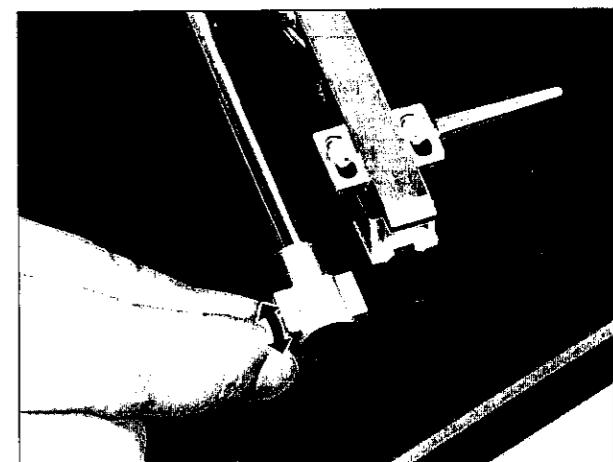


Figure 16

## CLEANING THE STYLUS TIP

To clean the stylus use a soft brush (not supplied). Wipe it in the direction of arrow shown in the illustration. Never touch the stylus with your fingers, or the stylus tip may break.

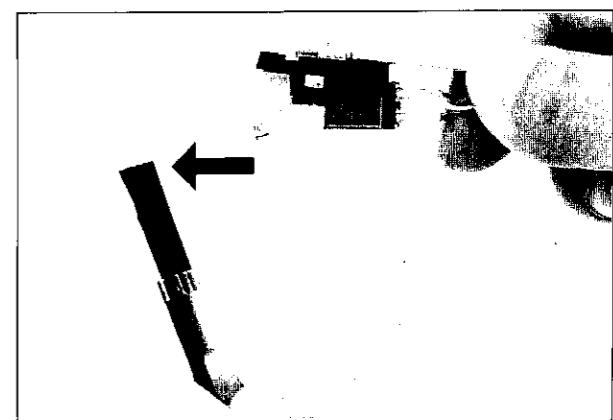


Figure 17

## CIRCUIT DESCRIPTION

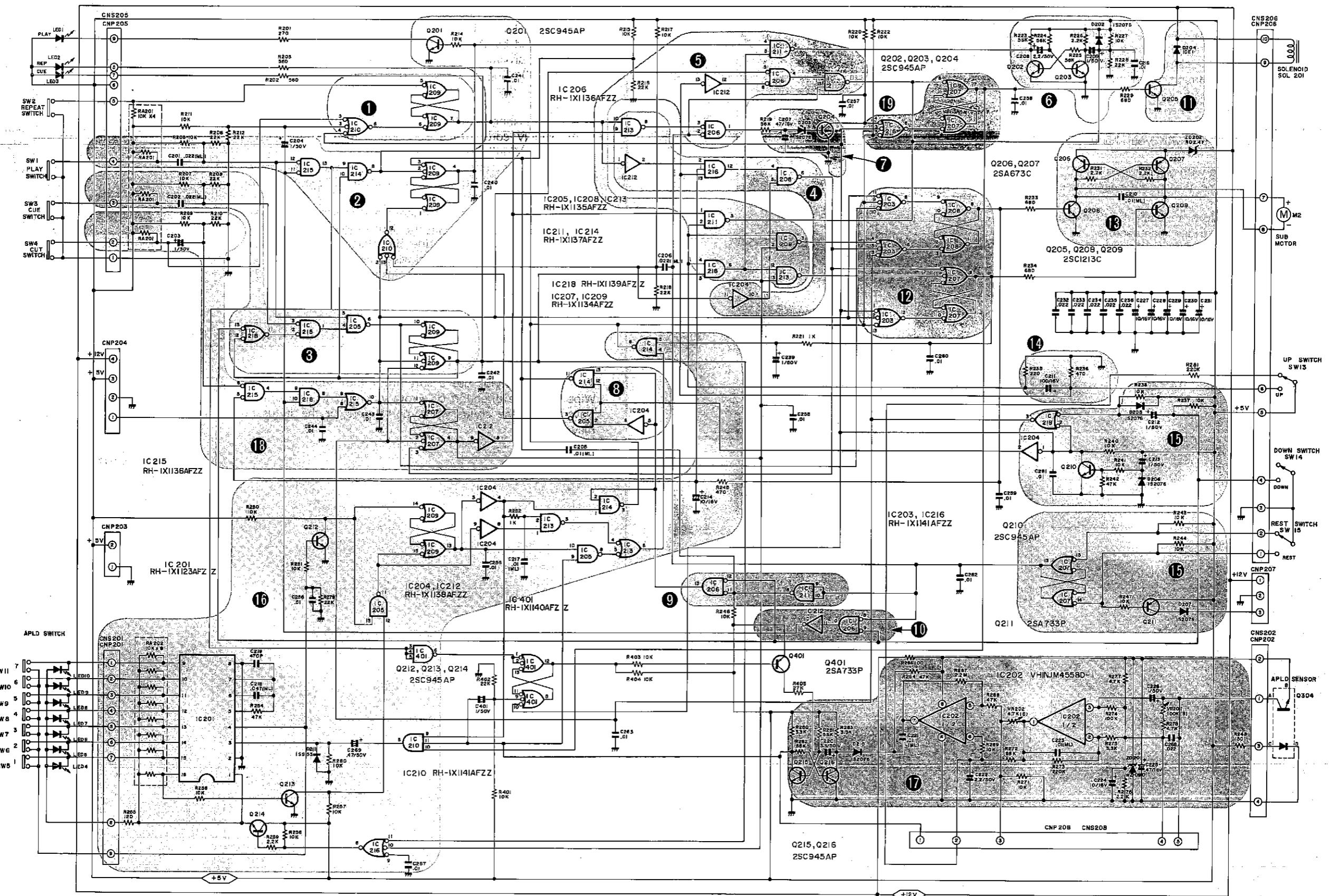


Figure 18 SCHEMATIC DIAGRAM OF LOGIC CIRCUIT

## ■ OUTLINE

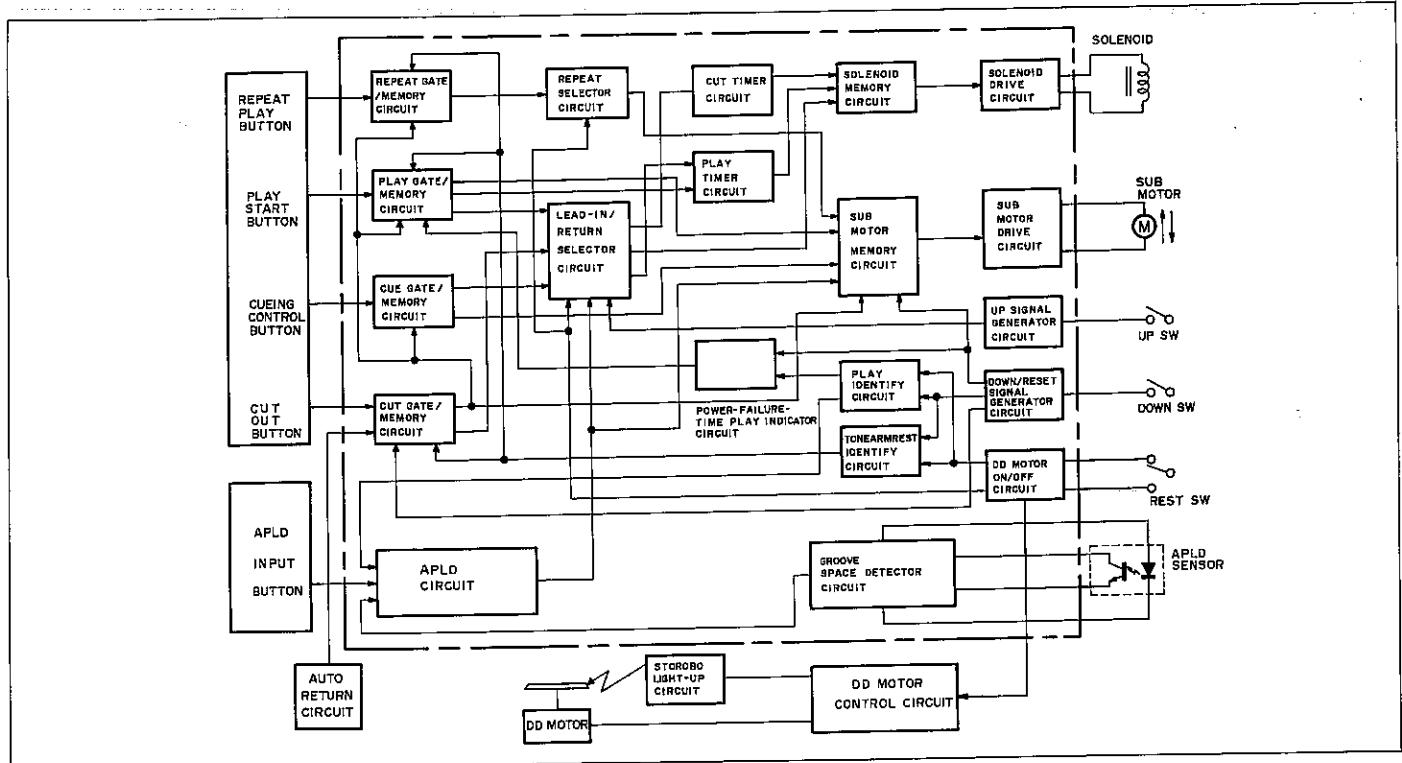


Figure 19 BLOCK DIAGRAM OF LOGIC CIRCUIT

### 1 REPEAT GATE/MEMORY CIRCUIT

Circuit which memorizes the unit is put in the repeat mode, and sends forth the signal to the repeat selector circuit. The signal is also used to turn the repeat indicator LED (LED2) on.

### 2 PLAY GATE/MEMORY CIRCUIT

Does not permit the unit to accept the play signal except when the tonearm is settled on its rest. This circuit also memorizes the unit is put in the play mode, and feeds the signal to the lead-in/return selector circuit. The signal is also used to turn the play indicator LED (LED1) on.

### 3 CUE GATE/MEMORY CIRCUIT

Does not let the unit accept the cue signal except while the cuing operation is performed. This circuit also memorizes the unit is put in the cue mode, and sends the signal to the lead-in/return selector circuit. The signal is also used to turn the cue indicator LED (LED3) on.

### 4 REPEAT SELECTOR CIRCUIT

Circuit which leads in the tonearm when it returns to its tonearm rest.

### 5 LEAD-IN/RETURN SELECTOR CIRCUIT

Selects which mode the unit is to be put in, among the lead-in, return and cue modes.

### 6 PLAY TIMER CIRCUIT

In the case of leading in, when the tonearm is lifted up there is required an interval during which the sub motor changes its rotational direction from the normal to the reverse; for that reason, this circuit works to delay an attraction of the solenoid by 90msec.

### 7 CUT TIMER CIRCUIT

When the tonearm returns to its tonearmrest, this circuit delays putting in the solenoid in action by 0.9 sec, even if the rest switch (SW15) is open (off).

### 8 POWER-FAILURE-TIME PLAY INDICATOR CIRCUIT

Turns the play indicator LED (LED1) on when power failes or temporarilly becomes off during playing.

### 9 PLAY IDENTIFY CIRCUIT

Identifies the unit is playing.

### 10 TONEARM REST IDENTIFY CIRCUIT

Identifies the tonearm is on its tonearm rest. The circuit also generates the signal for putting the play and repeat indicators off when the tonearm is manually put back to its tonearmrest.

### 11 SOLENOID DRIVE CIRCUIT

Drives the solenoid in response to the solenoid actuating signal.

### 12 SUB MOTOR MEMORY CIRCUIT

Memorizes the motor actuating signal specifying the normal or reverse direction rotation, and keeps it till the normal or reverse rotation stop signal is received.

### 13 SUB MOTOR DRIVE CIRCUIT

Drives the motor.

### 14 UP SIGNAL GENERATOR CIRCUIT

Circuit which generates the up signal of tonearm rest.

## 15 DOWN-RESET SIGNAL GENERATOR CIRCUIT

Comprises the following circuits:

Comprise the following circuits:

- (1) Circuit which generates the up and reset signals.
- (2) Rest switch (SW15) chattering prevention circuit and DD motor on/off circuit.
- (3) Circuit which generates the down and reset signals. motor when the tonearm is on its rest; and it generates the signal which actuates the DD motor when the tonearm leaves its rest.

## 16 APLD CIRCUIT

Puts the APLD (Auto Program Locate Device) in action.

## 17 GROOVE SPACE DETECTOR CIRCUIT

Detects a program void groove between programs.

## 18 CUT GATE/MEMORY CIRCUIT

Let the unit accept the motor actuating signal the normal or tonearm is settled on its rest.

This circuit also memorizes the unit is put in the cut mode, and sends the signal to the lead-in/return selector circuit.

## 19 SOLENOID MEMORY CIRCUIT

Memorizes the solenoid actuating signal and keep it till the solenoid stop signal received.

## **GROOVE SPACE DETECTOR CIRCUIT**

## **GROOVE SPACE DETECTOR CIRCUIT**

### (1) Program-to-program space detector

By the difference in reflection factor of infrared rays between no-sound-groove and sound-groove, this detector detects spaces between programs; when the sensor arm reaches a no-sound-groove the collector voltage of the APLD SENSOR Q304 becomes as shown by the waveform (A). The longer the no-sound-groove is, the wider this waveform width becomes.

## (2) Output amplifier circuit

The waveform (A) is here amplified in terms of A.C. so that the waveform (B) is obtained.

### (3) Waveform shaping circuit

Shapes the waveform **(B)** into a square wave; the result is as shown by the waveform **(C)**

**(4) Groove pulse generator circuit**

Differentiates **D**, the waveform **C** once, and generates the program-to-program pulse with constant width. The pulse takes on a waveform as shown by **E**.

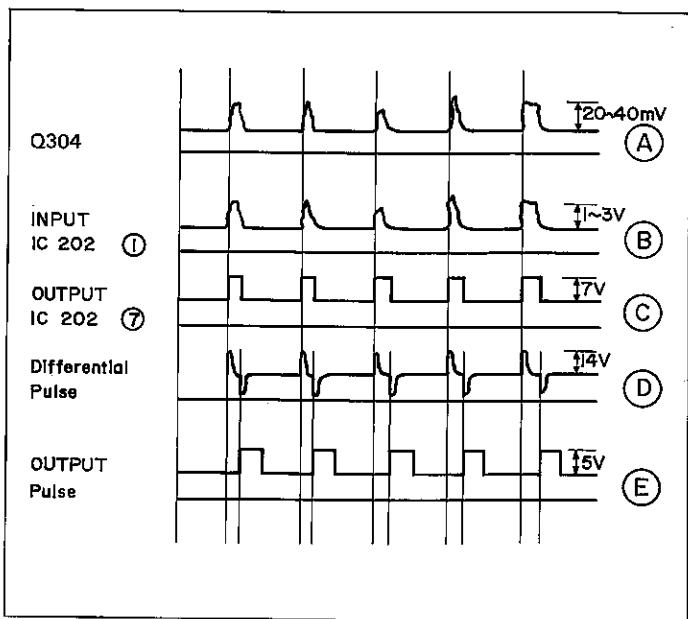


Figure 20

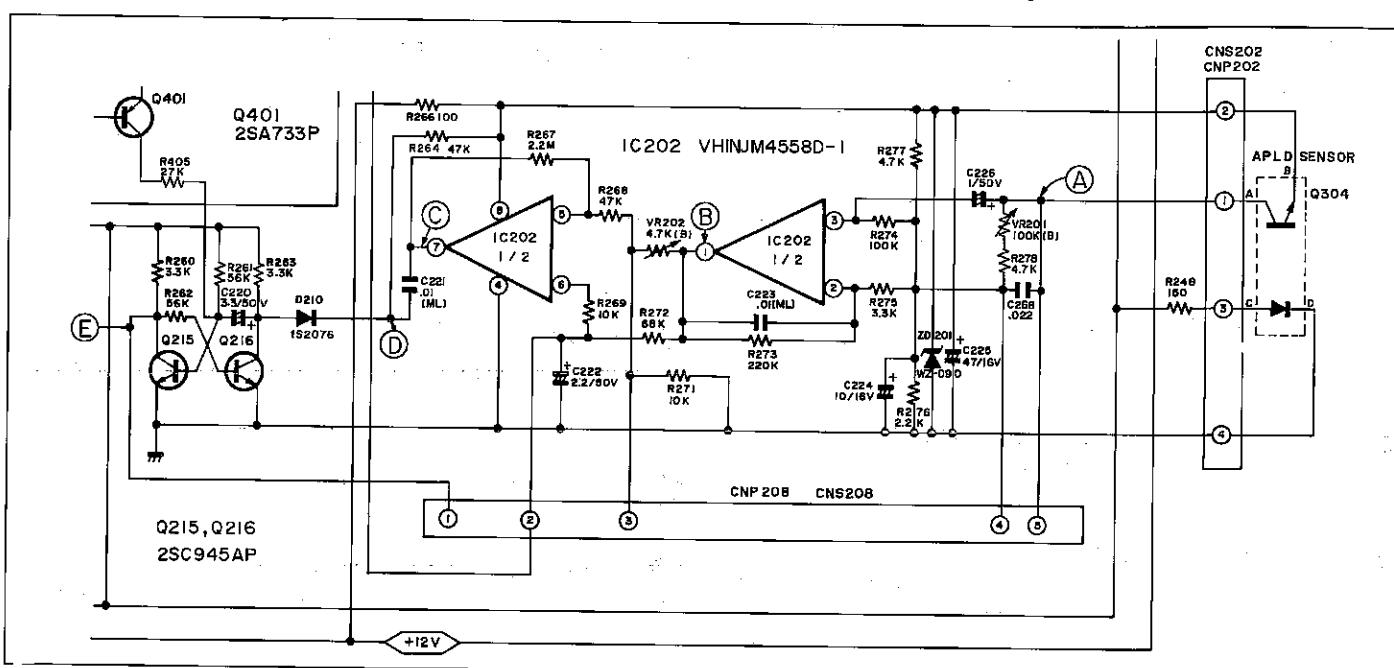


Figure 21

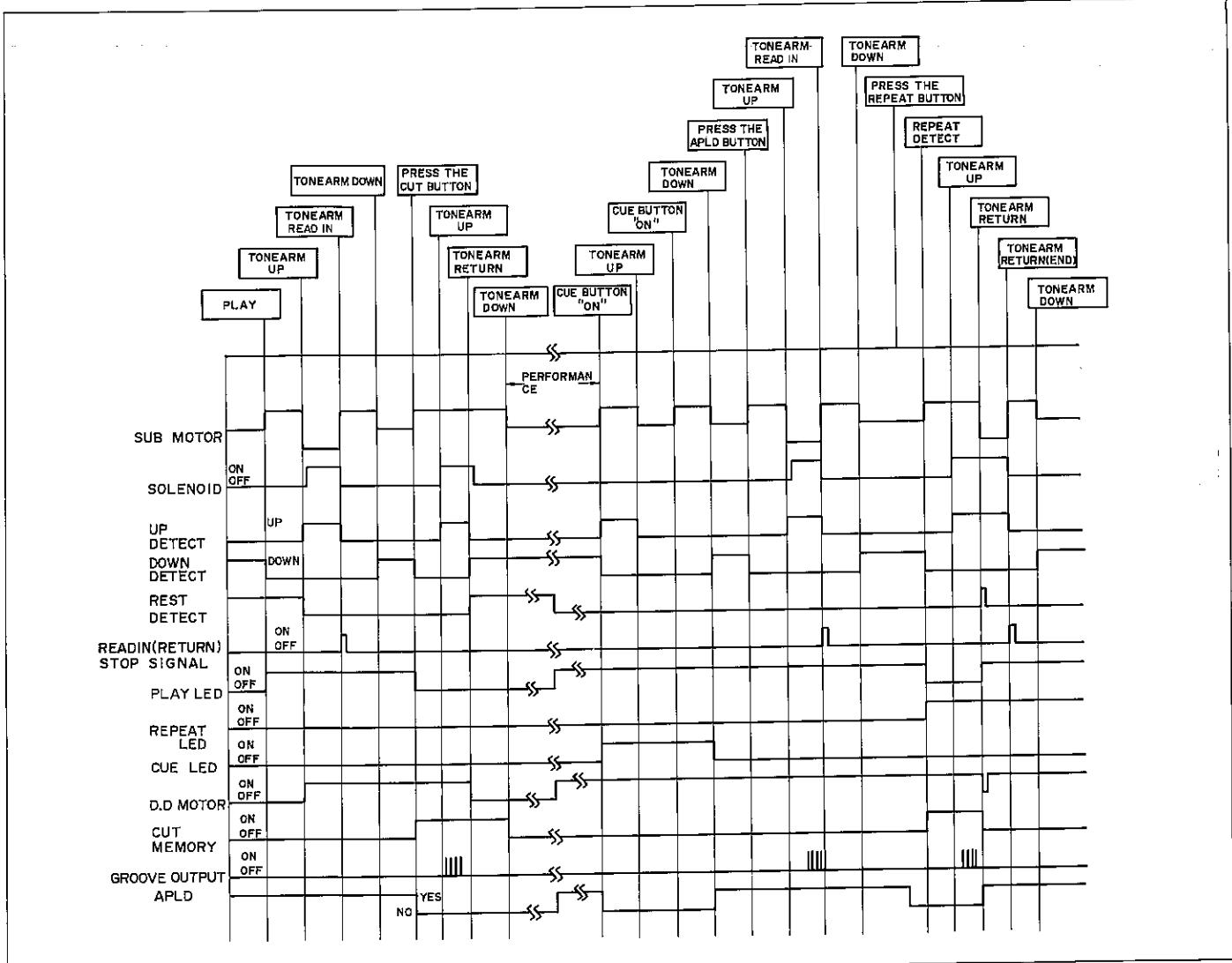


Figure 22 TIME CHART

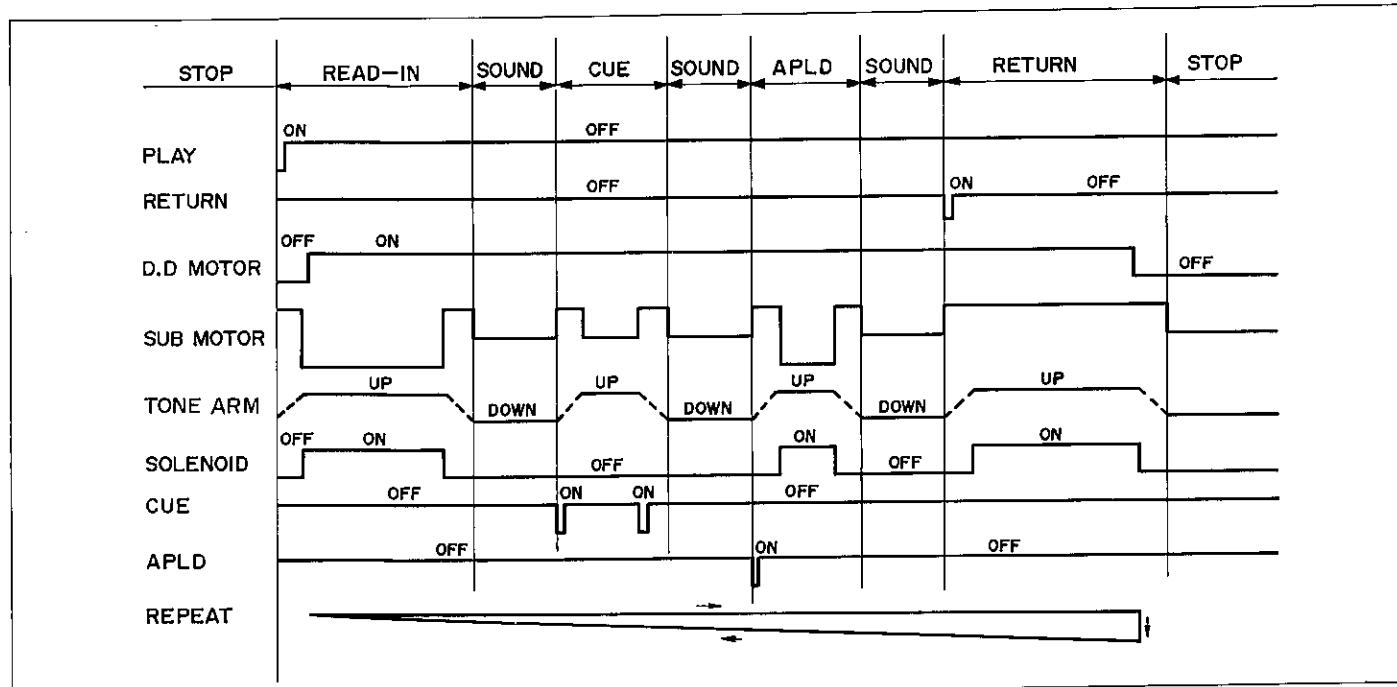


Figure 23 TIME MODE CHART

## BEHAVIORS OF LOGIC CIRCUIT (See Figure 24)

① When the play start button is depressed with the power switch SW12 set at "on", the play indicator LED (LED1) lights up, and the tonearm moves away its rest, then it ascends. --- at the time, the sub-motor is rotating in clockwise direction. When the tonearm reaches its "up" position thoroughly, the sub motor now changes its rotating direction: say, it rotates in counterclockwise direction to get action of the solenoid, so that the tonearm will slide towards the surface of a record.

A signal flow corresponding to the abovementioned is revealed in Section ① of the separate Signal Flow Chart. In Section ① of the Chart, the non-shaded zone shows a signal flow up to the process where the tonearm "up" motion stops: while the shaded zone up to the process where the tonearm begins to slide towards the record surface.

In the following descriptions ② thru ⑩, it is preferred for you to refer to this Chart now and then for better understanding.

② As the tonearm slides towards the record surface, the APLD sensor Q304 finds out the 1st groove of a record (or the pre-designated groove in the case of APLD operation), and with this, the sub motor changes the rotation from counterclockwise to clockwise direction and simultaneously the solenoid stops to function. As a result, the tonearm begins to descend onto the record, the sub motor stops to rotate, and the unit gets in play mode. The abovementioned is illustrated in Section ② of the Chart. The non-shaded zone shows a signal flow up to the process where the solenoid stops to function while the shaded zone, the process thereafter.

The term "APLD" in the Chart means the process where the unit is under APLD operation.

③ When the cueing control button is pushed during play mode, signals are caused, as shown in the non-shaded zone in Section ③ of the Chart, so as to have the cue indicator LED (LED3) light up and also to let the sub motor change the rotation from counterclockwise to clockwise direction --- with this, the tonearm comes off the record surface and it will ascend to the full extent. Next, signals are caused as shown in the shaded zone of the Chart, to stop the rotation of the sub motor eventually.

④ If the cueing control button is pushed once again, signals are caused as shown in the non-shaded zone in Section ④ of the Chart, to have the sub motor rotate in clockwise direction, then the tonearm will thus descend onto the record surface. Next, signals are caused as shown in the shaded zone of the Chart, to stop the rotation of the sub motor with the cue indicator LED (LED3) going off.

⑤ When a play is finished (say, the tonearm reaches the end groove of record), or when the cut-out button is pushed during play mode, signals are caused as shown in the non-shaded zone in Section ⑤ of the Chart, resulting in that: the play indicator LED (LED1) is put off; the sub motor rotates in clockwise direction; the tonearm comes off the record surface and ascends. Next, signals are caused as shown in the shaded zone of the Chart, so the solenoid functions and the tonearm comes back to its rest.

⑥ The moment the tonearm reaches its rest, signals are caused as shown in the non-shaded zone in Section ⑥ of the Chart, so the solenoid stops to function and the tonearm enters the inside of its rest. Next, signals are caused as shown in the shaded zone, to stop the rotation of the sub motor and to reset the memory (of play mode).

⑦ If the cueing control button is pushed when the tonearm is inside its rest, the tonearm comes off its rest and ascends. In this state, if the cut-out button is further pushed, signals are caused as shown in the non-shaded zone in Section ⑦ of the Chart, so the sub motor rotates in clockwise direction to have the tonearm again descend onto its rest. Thereafter, signals are caused as shown in the shaded zone of the Chart, resulting in that the sub motor stops to rotate and the memory (of play mode) is reset.

⑧ If the play start button is pushed when the tonearm is inside its rest, the play start LED lights up, and the tonearm comes off its rest and ascends while moving towards the record surface. Under this state, if the cut-out button is further pushed, signals are caused as shown in the non-shaded zone in Section ⑧ of the Chart, so the sub motor changes the rotation from counterclockwise to clockwise direction, the play start LED is put off and the tonearm comes back to its rest. Thereafter, signals are caused as shown in the shaded zone of the Chart, resulting in that the solenoid stops to function, the tonearm enters the inside of its rest and the sub motor stops to rotate.

⑨ Pushing the repeat play button will enable the unit to perform auto-return operation of the tonearm. Here is shown what the auto-return operation is referring to Section ⑨ of the Chart.

If the repeat play button is pushed, signals are caused as shown in the non-shaded zone in Section ⑨ of the Chart, so the repeat indicator LED (LED2) lights up and the repeat signal is memorized in the unit: with this, it is in play mode that when the tonearm reaches the end groove of record, it, in turn, comes back automatically to its rest. Thereafter, signals are caused as shown in the shaded zone of the Chart, resulting in that the sub motor changes the rotation from clockwise to counterclockwise direction and the unit again starts play from the beginning.

⑩ If any one of the APLD number buttons (1 to 7) is pushed during play mode, signals are caused as shown in Section ⑩ of the Chart, so the sub motor rotates in clockwise direction, and the tonearm comes off the record surface and ascends. Thereafter, signals are caused as shown in the shaded zone and as a result, the sub motor changes the rotation from clockwise to counterclockwise direction and the solenoid functions. With the solenoid operation, the tonearm shifts above a record to find out a program-to-program space (groove) of it --- now, the sub motor keeps the counterclockwise rotation. Next with such groove detected, signals are caused as shown in the non-shaded zone in Section ⑪ of the Chart, resulting in that the sub motor changes the rotation from counterclockwise to clockwise direction, the solenoid stops to function and the tonearm finally descends onto the detected groove. Thereafter, signals are caused in the shaded zone of the Chart, so the sub motor stops to rotate and the unit starts to play.

## SIGNAL FLOW CHART

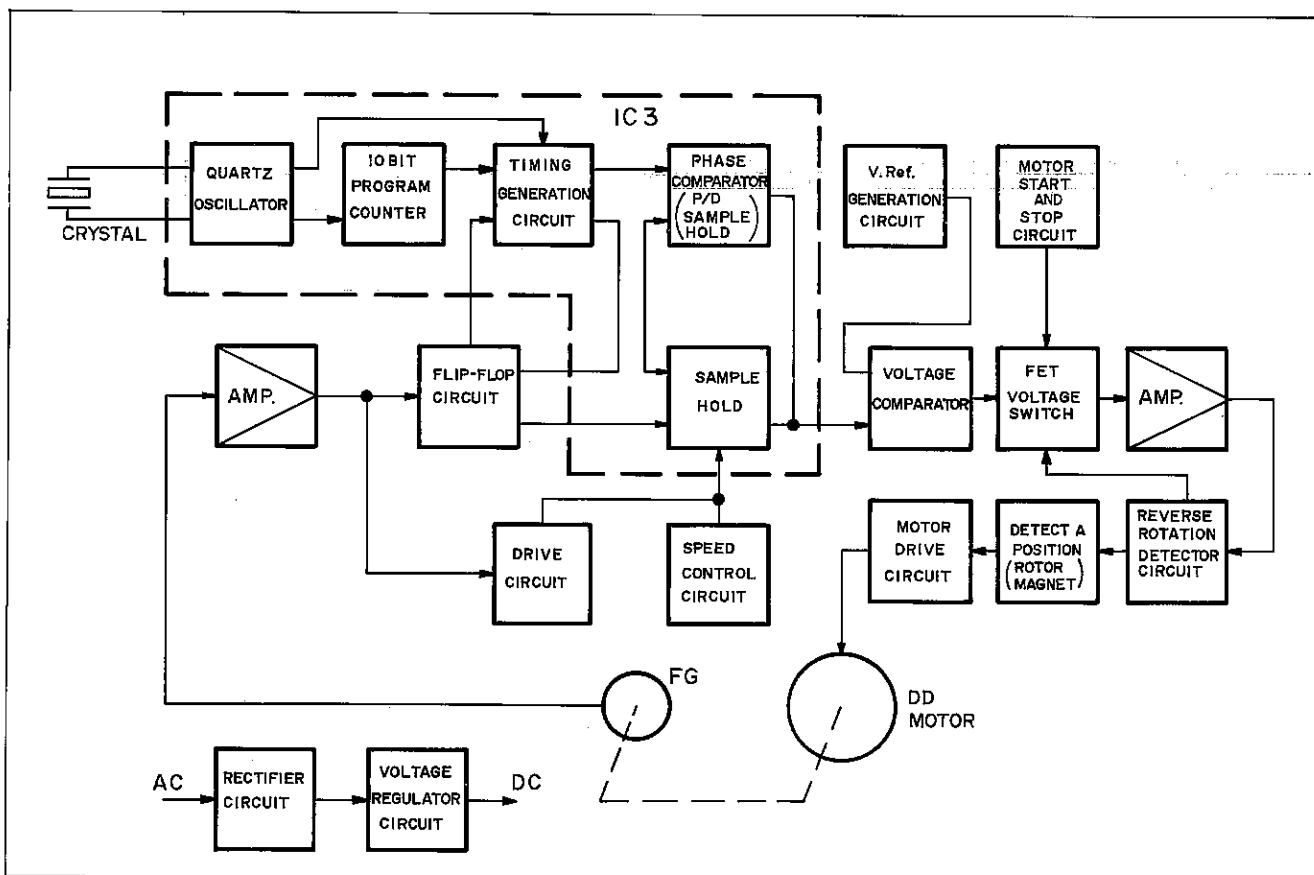


Figure 24

## ■ BEHAVIORS OF CONTROL CIRCUIT

The control circuit consists of a frequency generator servo circuit and sync circuit; the frequency generator servo circuit produces the signal according the speeds of the turntable which rotates coaxially with the motor.

and the sync circuit provides a phase control with a quartz oscillator signal as a reference. Described below are details of each part with the block diagram referred

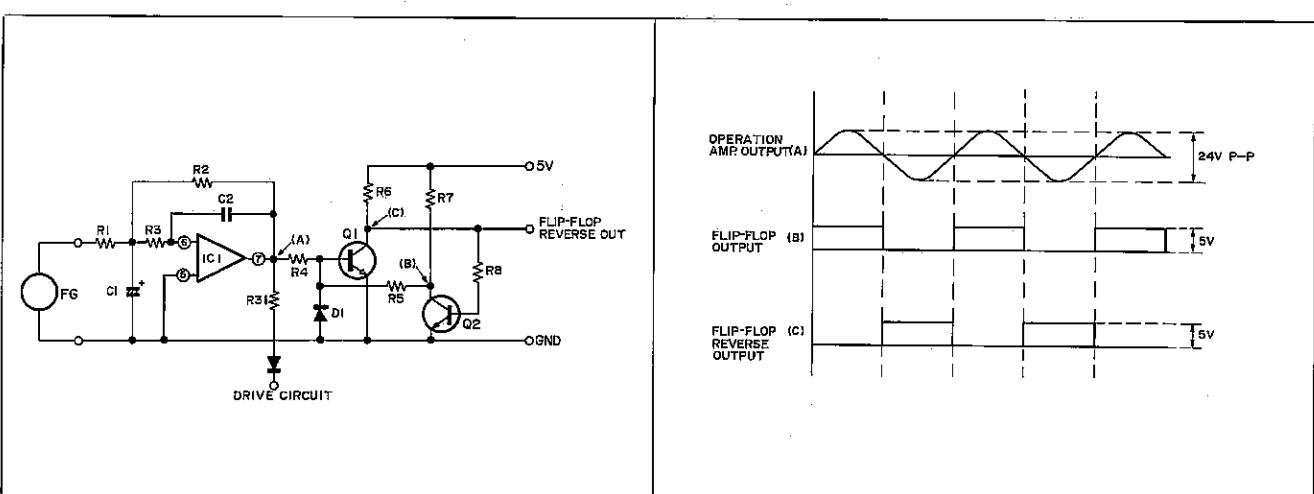


**Figure 25 BLACK DIAGRAM**

### (1) Frequency generator, amplifier and flip-flop circuit

The frequency generator comprises a 160-pole magnet, a multigap head having 80-pair-pole teeth and coils. The frequency generator produces the 44.44 Hz sine-wave signal when playing the LP (33-1/3 rpm) record, and the 60 Hz sine-wave signal in the case of the EP

(45 rpm) record; the signal is amplified by the operational amplifier IC1 (1/2) and the 24 V peak-to-peak waveform (A) is obtained; then the waveform (A) is sent to the flip-flop circuit so that the rectangular waveform of 50% duty cycle is obtained.



**Figure 26**

(2) Operation control timing generator circuit and F/V sample hold circuit

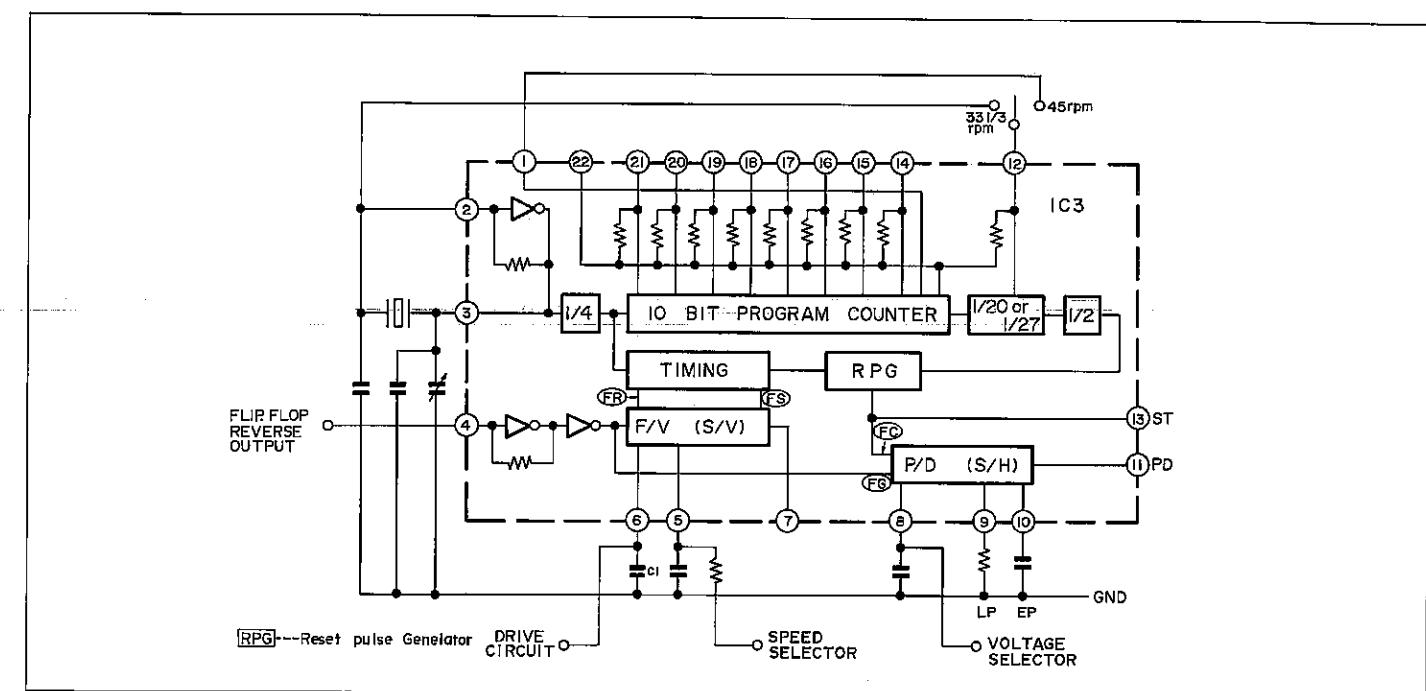


Figure 27 BLACK DIAGRAM OF PLL IC (IC3)

The timing generator circuit is actuated by a pulse gained by dividing the quartz oscillator frequency to quarter.

When the starting part of the frequency generator's FG flip-flop reaction output enters the FV sample hold circuit, it is held by means of the sample pulse of the timing generator circuit so that the hold output voltage FV is obtained.

Thereafter, the reset pulse (FR) from the timing generator circuit discharges the load from C1, and the saw tooth wave (EVS) is obtained.

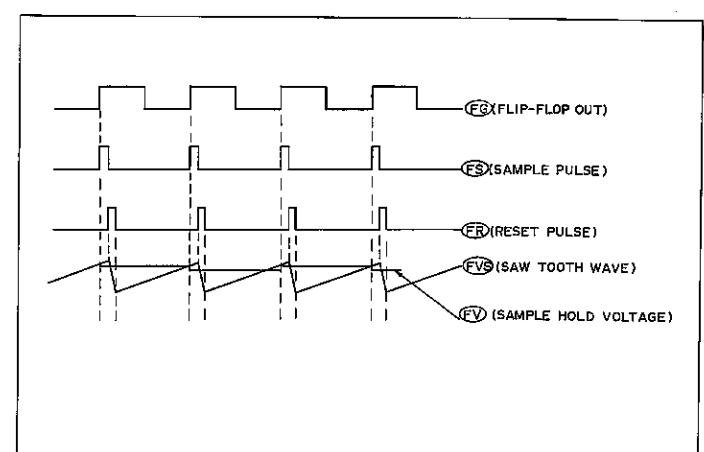


Figure 28 SIGNAL FLOW CHART

### (3) Quartz oscillator and 10-bit program counter

This is a C-MOS inverter oscillator and the oscillation frequency can be adjusted by using the trimmer capacitor VC1 which is connected in parallel with the load of the quartz.

Quartz is of 9.3312 MHz type.  
The programing is so designed that the frequency is divided by 972 for both LP and EP records to be played.

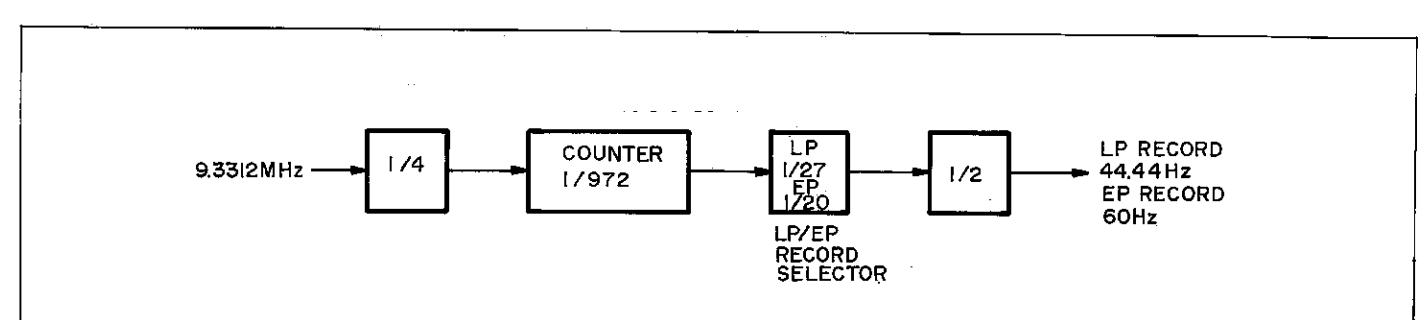


Figure 29 FREQUENCY DIVIDER

#### (4) Phase comparator circuit (P/D sample hold)

By the strobo signal output pulse, this circuit generates the saw tooth wave. Besides, the circuit is appended with a bootstrap circuit so that the resultant saw tooth wave will have an excellent linearity.

This saw tooth wave is sample-hold by the flip-flop (FG) inversion of frequency generator.

Moreover, the phase comparator circuit is designed to be kept off by a switch when the quartz lock is off.

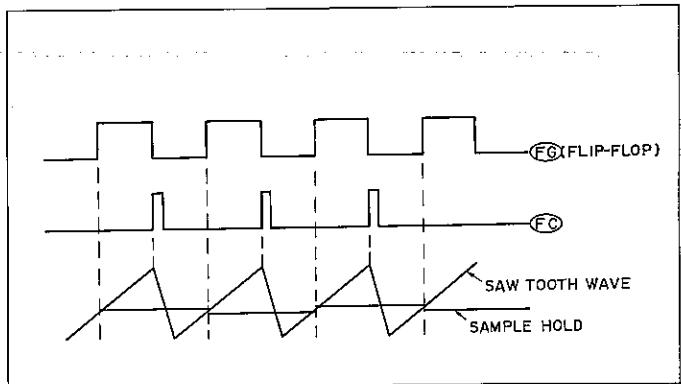


Figure 30 PHASE COMPARATOR

#### (5) Strobo signal output circuit

At pin (12) of IC3 this circuit, the output from the frequency divider circuit is more divided by 27 in the case of the LP record, and by 20 in the case of the EP one; then it is divided further by 2. And the reset pulse generator takes a timing pulse out of it to create a strobo signal.

- This timing pulse is also used as a reference signal for the P/D sample hold circuit.

#### (6) Reference voltage circuit (Voltage comparator)

Circuit which sets rpm of the DD motor; the constant voltage for it is obtained by making the output of the constant voltage circuit subject to a resistance-type voltage division.

This circuit compares the added output of the phase comparator and (FV) sample hold circuit with the reference voltage.

#### (7) Reversing rotation detector circuit (FET voltage switch) (See Figure 50)

When the output from the voltage comparator becomes below 0 V (in the case of reversing rotation), the transistor at the lower side of this circuit is turned off.

At that time, the voltage at the source-to-gate junction of the FET (Q3) becomes lower than the pinch-off voltage, and the resistance at its drain-to-source junction becomes higher so that the signal stops being fed to the Hall element (HE). Until the capacitor in the gate is charged up, the

voltage at the source-to-gate junction is higher than the pinch-off voltage and the reversing rotation brake is therefore applied.

The FET voltage switch puts the FET in conduction or cutoff by means of the motor start or stop signal. It also puts the FET in conduction or cutoff by means of the signal from the reversing rotation detector circuit (in the case of reverse rotation of the motor).

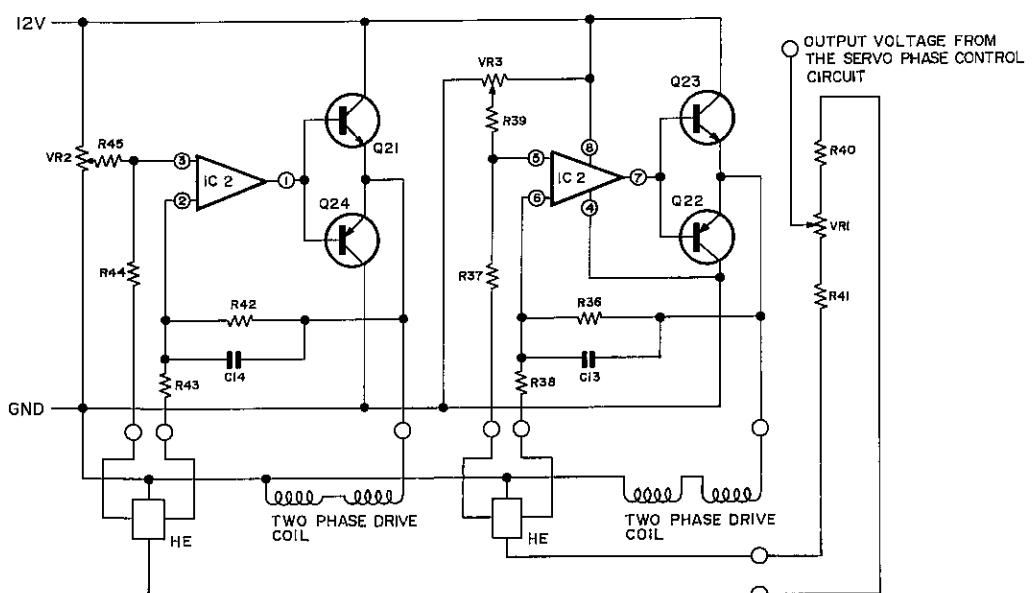


Figure 31 DD MOTOR DRIVE CIRCUIT

### (8) DD motor drive circuit (See Figure 31)

This circuit detects a position of the rotor magnet by means of the Hall element (HE) and determines an order of the currents to feed to the two-phase drive coil. Besides, the voltage applied to the Hall element is controlled by the servo phase control circuit; the output voltage from the Hall element is varied according to variation of the rotation phase; then that output voltage is amplified by the operational amplifier IC2 to feed the current into the drive coil.

### (9) Rectifier circuit (Constant voltage circuit)

This circuit rectifies the AC input by 4 diodes D11 ~ D14. The voltage by the zener diode ZD1 is 5.6 V; the 5.6 V constant voltage is taken out by the emitter-follower type transistor Q14.

The +12 V voltage is stabilized by the way that: the voltage subjected to a voltage division by the R50, R51 and VR4 is compared with the reference voltage provided by the ZD1, by means of the Q15.

When the +12 V voltage is thus stabilized, base current of the control transistor is governed by the transistor Q18 with the aid of voltage division by R54, R55 and R56 so that -12 V voltage is also stabilized.

The 12 V voltage can be adjusted externally by the variable resistor VR4.

- ① Allowable range for entry of the APLD Button at the control section.
- ② Except when the motor rotates in the normal direction.
- ③ Only during the time of playing.

### (10) Tonearm moving speed detector circuit

When the tonearm comes near the end groove of the record, the shutter installed beneath the arm enters between the LED and the photo-transistor so that the voltage at the collector of the photo-transistor varies as shown by (A) in the figure. And the voltage (A) runs through C301 and takes on an output waveform as shown by (B). This voltage increases when the tonearm moving speed becomes faster.

#### Voltage comparator

Applies the reference voltage (C) to pin ② of IC301 (the operational amplifier), and the voltage (B) to pin ③

#### Return pulse generator

Divides the output of IC301 by R308 and R303; and the divided output becomes the output pulse (E).

#### Reference voltage switch

Since the required output voltage (C) is different between 33 rpm and 45 rpm records, the reference voltage is changed by this switch; in the case of 33 rpm, the transistor Q301 is ON to make VR302 and R315 a parallel connection so that the voltage (C) becomes low.

### (11) Strobo light-up circuit

To pin ⑬ of IC3, the 44.44 Hz pulse is fed when playing the LP record, and the 60 Hz pulse when playing the EP record; and this circuit turns on the transistor Q104 by means of the abovementioned pulses to trigger the monostable multivibrator. Q102 of this monostable multivibrator is in conduction and Q103 of it is cut-off in the stable state; but when the trigger pulse is fed into it, Q102 is turned off and Q103, on to light up the LED just during a period which is determined by R104 and C105.

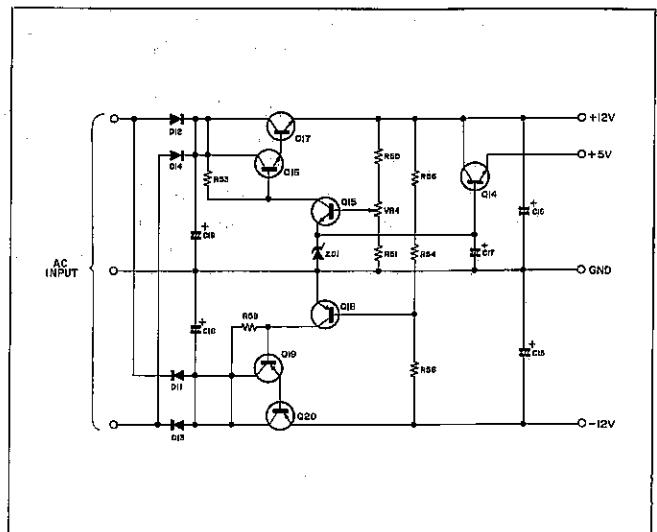


Figure 32 RECTIFIER CIRCUIT

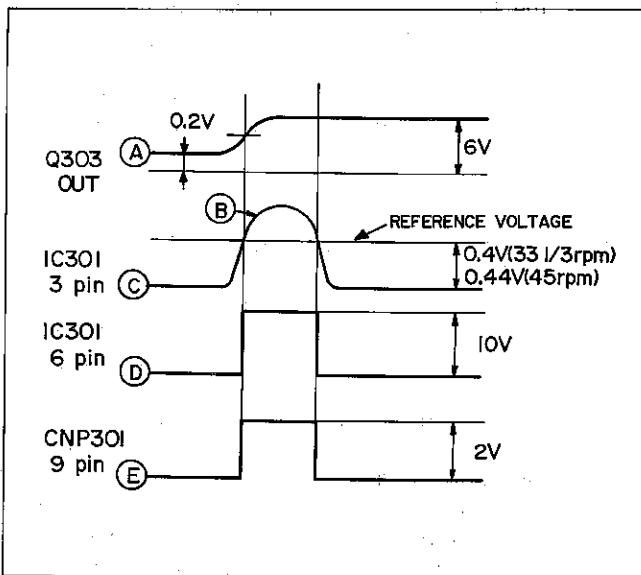


Figure 33 TIME CHART

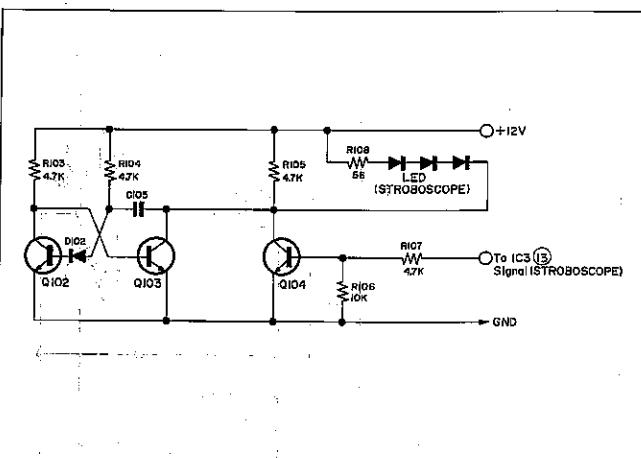


Figure 34 STROBO LIGHT-UP CIRCUIT

ALIGNMENT POINTS

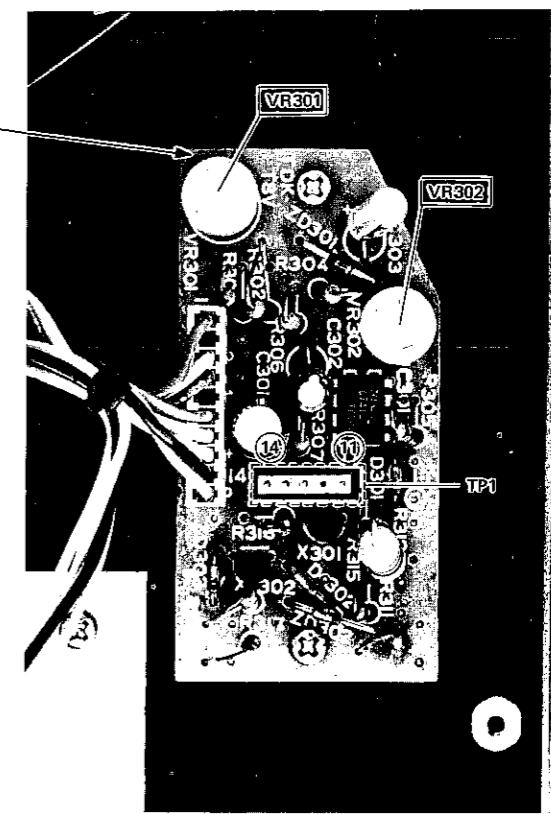
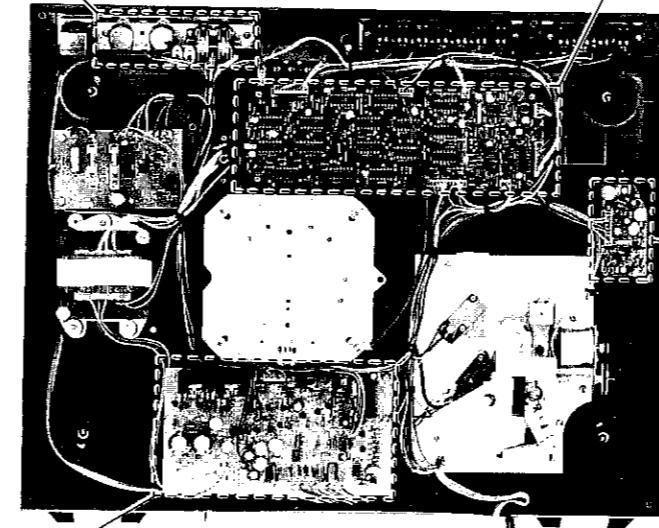
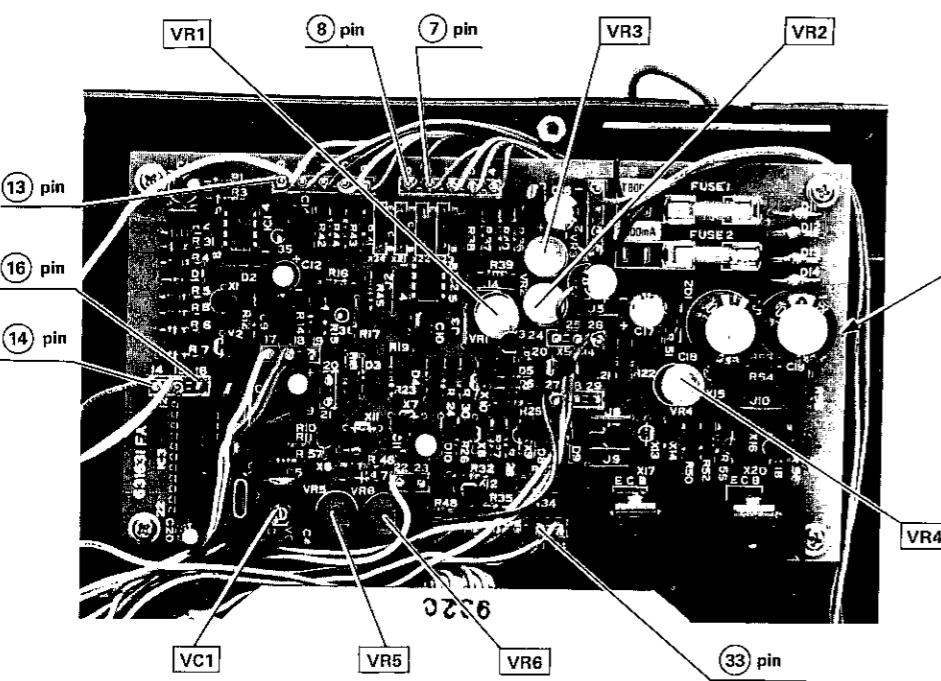
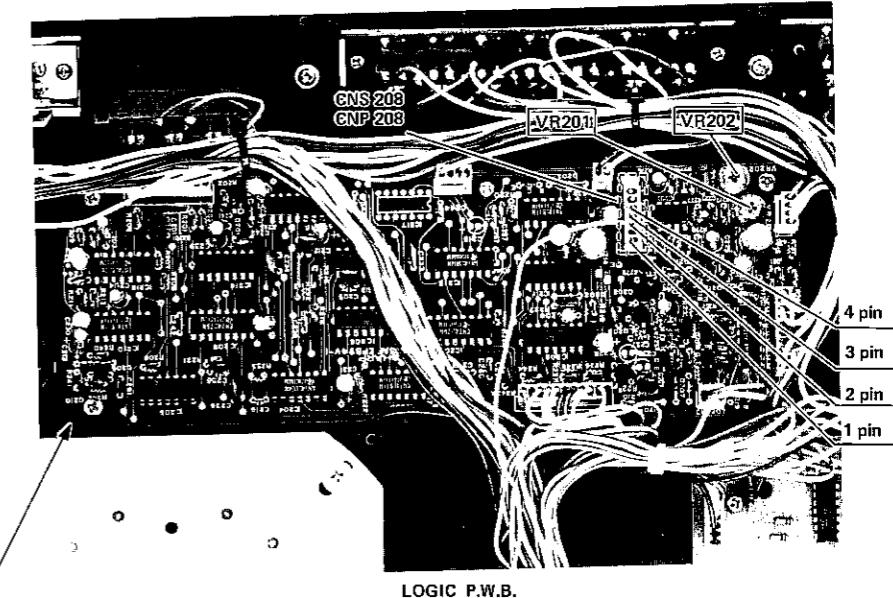
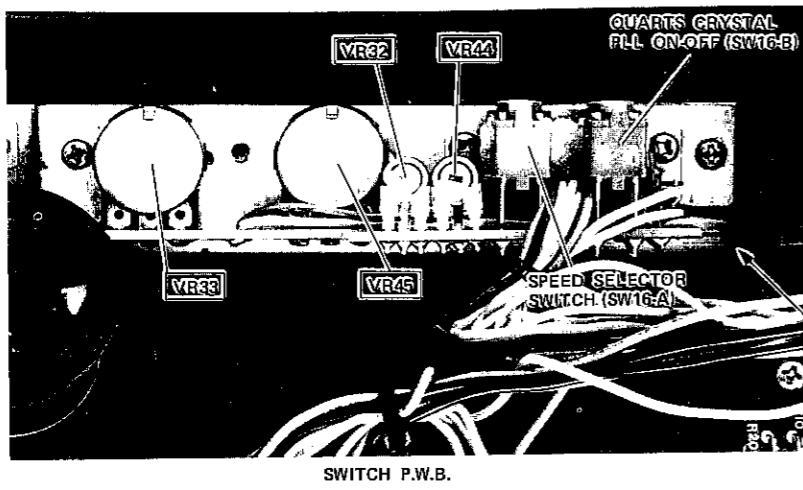


Figure 35

## ADJUSTMENT

### STYLUS HEIGHT ADJUSTMENT (LEAD-IN HEIGHT)

1. Put the power supply cord of the unit into a wall outlet; Set the power switch in "on" position; then press the cueing control button to send the tonearm up.
2. Manually hold the headshell grip; bring it over the record; then put the tonearm onto the tonearm lifter.
3. Turn the adjustment screw of the tonearm lifter using a screwdriver having a form as shown in the figure in order to adjust the stylus height.

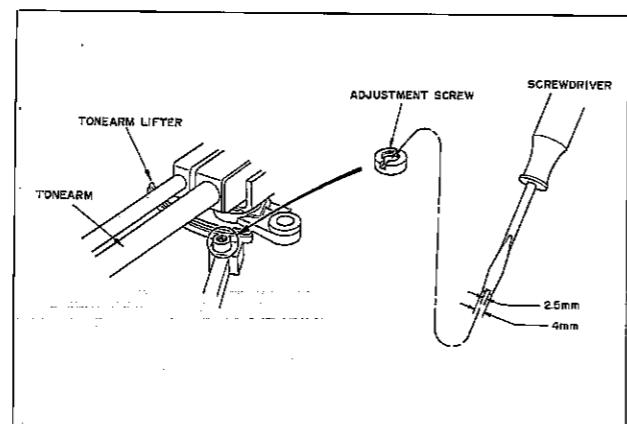


Figure 36

### AUTO RETURN ADJUSTMENT

1. Set the speed selector switch to "33 rpm" position.
2. Play the test record (SSR-4001), and adjustment screw so that the return count becomes  $14 \pm 1$ .
3. Change the selector switch to "45 rpm" position, and make sure of the proper function.

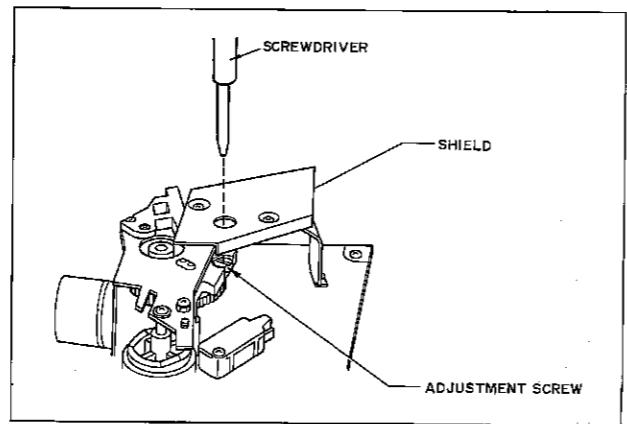


Figure 37

### SENSITIVITY ADJUSTMENT

1. Put the test record (TOSHIBA LF1003 or equivalent) on the turntable.
2. Set the power switch to "on" position.
3. Lift up the tonearm by pressing the Cueing control button.
4. Set the power switch to "off" position.
5. Move the headshell on the lead out groove of the test record by finger.
6. In this condition, unplug the connector socket CNS208 from the connector plug CNP208 mounted on the logic P.W.Board.
7. Connect the DC VTVM to the pin terminals of the connector plug CPN208 [Pin 5 (positive), Pin 4 (negative)], and adjust the variable resistor VR201 so that the VTVM reads 30 mV ( $30 \pm 2$  mV).
8. Next, set the tonearm on the tonearm rest.
9. Change the connection of the DC VTVM to the pin terminals of the connector plug CPN208 [Pin 2 (positive), Pin 3 (negative)], and adjust the variable resistor VR202 so that the DC VTVM reads 0.2V ( $0.2 \pm 0.01$  V).

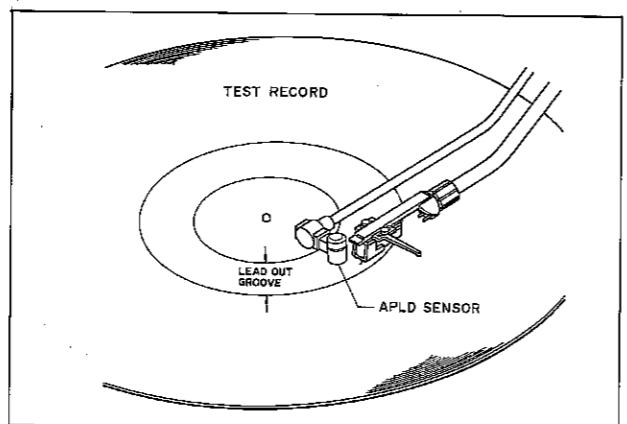


Figure 38

### CHECKING OF THE APLD SENSOR HEIGHT

Check the height and horizontal of the APLD sensor against the record surface on the turntable.

1. Set the power switch to "on", press the cueing control button, move the headshell over the record, and set the power switch to "off".
2. Make sure the height of sensor bottom from the record surface to be within  $4.5 \pm 1$  mm, and at the same time to be parallel with record surface.
3. If, not correct, loosen the two screws fixing the sensor arm pipe at its root, and modify the height and horizontal of the sensor by rotating the sensor arm pipe. Never forget the screws fixing.

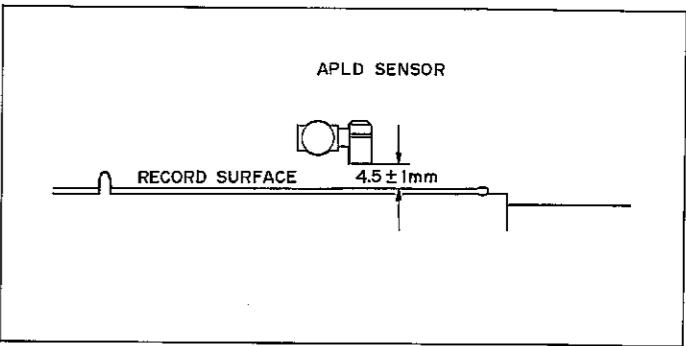


Figure 39

### QUARTZ LOCK TIMING ADJUSTMENT

1. Connect one end of a dual-beam synchroscope, on the control PWB, between pin ⑬ (GND) and pin ⑭ and another between pin ⑬ (GND) and pin ⑯.
2. Setting the speed selector at "33 rpm" position, adjust the variable resistor VR5 so that strobo signal pulse and frequency generator's signal pulse will be shown in Figure 40.
3. Next with the speed selector set at "45 rpm" position, further adjust the variable resistor VR6 so that strobo signal pulse and frequency generator's signal pulse will be shown in Figure 41.

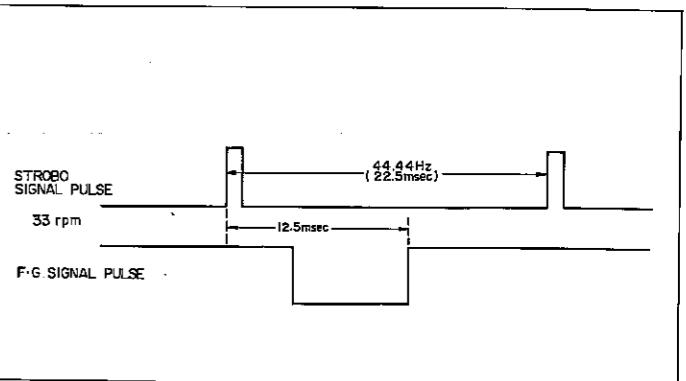


Figure 40

### TONEARM RETURN DETECTOR ADJUSTMENT

1. Put the tonearm onto its tonearm rest.
2. Connect a VTVM between TP1-⑭ and TP1-⑬ (GND).
3. Adjust the variable resistor VR301 so that the VTVM reads 0.2 V.

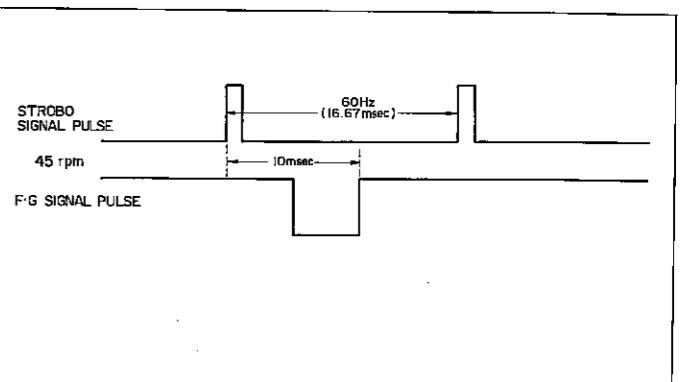


Figure 41

### DETECTED SENSITIVITY ADJUSTMENT

1. Put the tonearm onto its tonearm rest.
2. Set the speed selector to "33 rpm" position.
3. Connect a VTVM between TP1-⑪ and TP1-⑬ (GND).
4. Adjust the variable resistor VR302 so that the VTVM reads 0.4 V.
5. Set the speed selector to "45 rpm" position, and make sure the VTVM shows 0.44 V.

## ADJUSTMENT OF MOTOR DRIVE ADJUSTMENT

1. Connect one end of a dual-beam oscilloscope, on the control PWB, between pin ⑬ (GND) and pin ⑧ and another between pin ⑬ (GND) and pin ⑦.
2. Turn the variable resistors VR2 and VR3 to generate two waveforms and adjust so that these two will have symmetry vertical, as shown in Figure 42.
3. Adjust the variable resistor VR1 so that the two waveforms will be the same in their peaks.

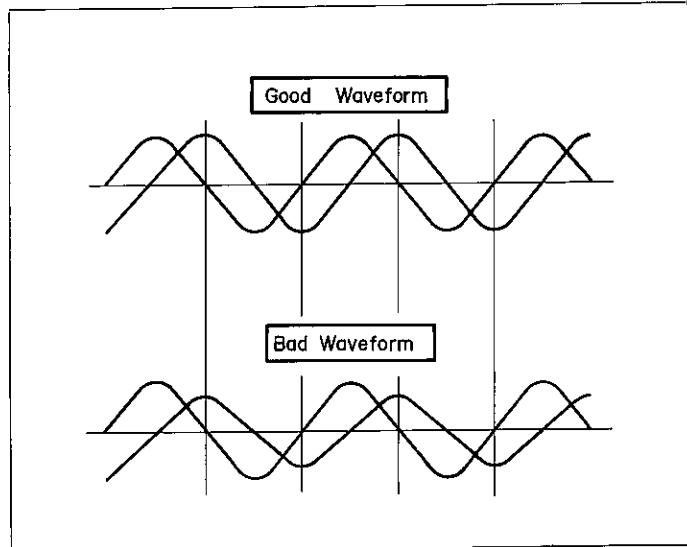


Figure 42

## PITCH FINE ADJUSTMENT

1. Set the pitch adjust controls VR33 and VR45 to their respective mechanical center position.
2. Setting the speed selector at "33 rpm" position, adjust the variable resistor VR32 so that stripe patterns of the

stroboscope will be motionless.

3. Next with the speed selector set at "45 rpm" position, further adjust the variable resistor VR44 so that stripe patterns of the stroboscope will be motionless.

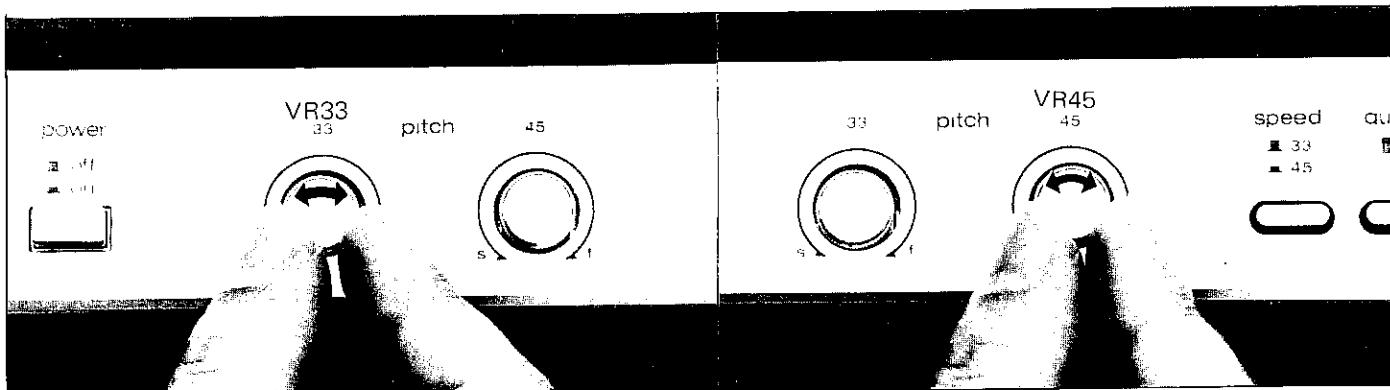
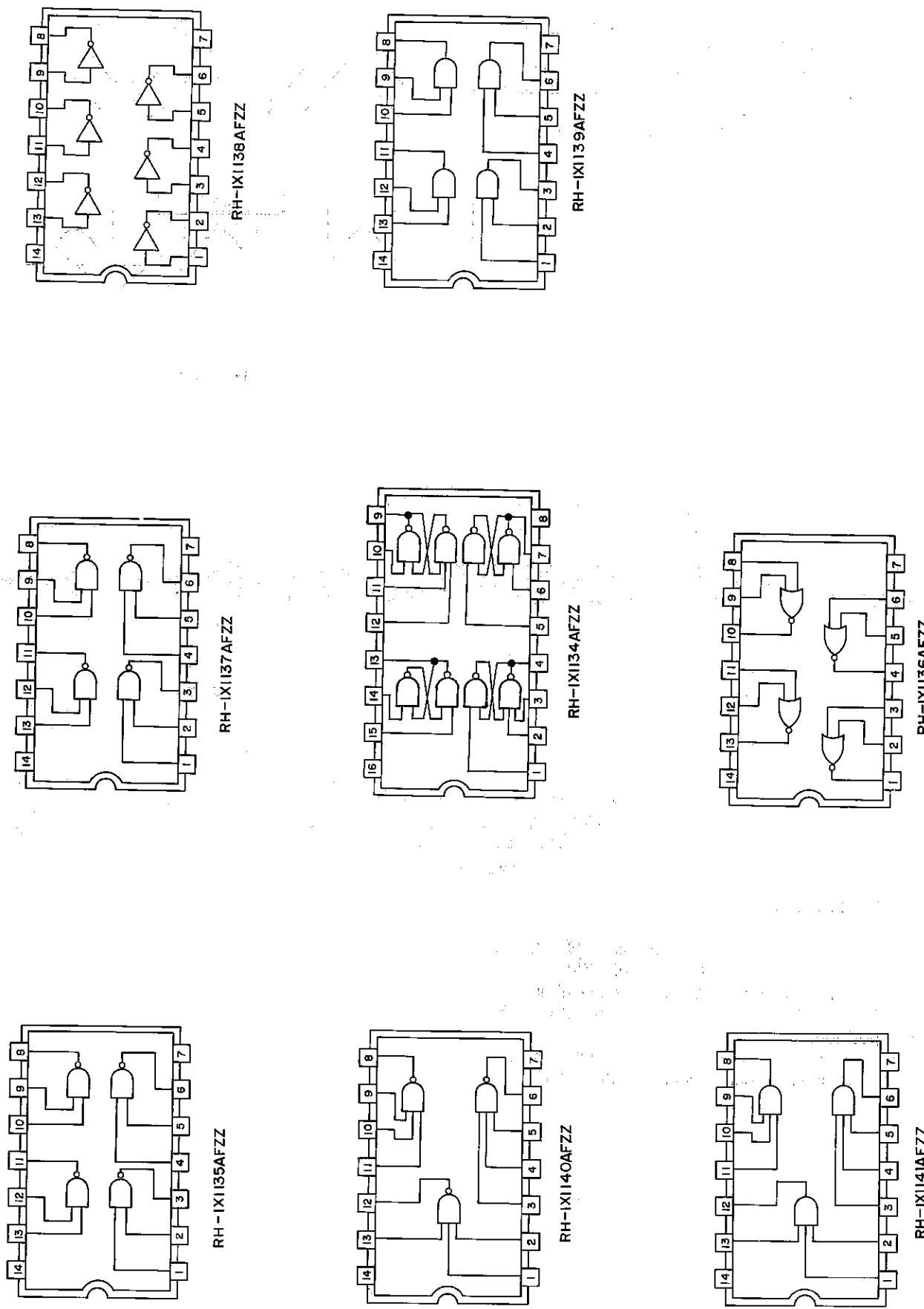


Figure 43

## FREQUENCY ADJUSTMENT

1. Connect a frequency counter between pin ⑬ (GND) and pin ⑭, respectively of the control PWB.
2. Adjust the variable capacitor VC1 so that the frequency counter will read 44.44 Hz with the speed selector set at "33 rpm" position.
3. Next with the speed selector set at "45 rpm" position, see that the frequency counter will indicate 60.00 Hz.

Figure 44 TOP VIEW OF LOGICAL IC



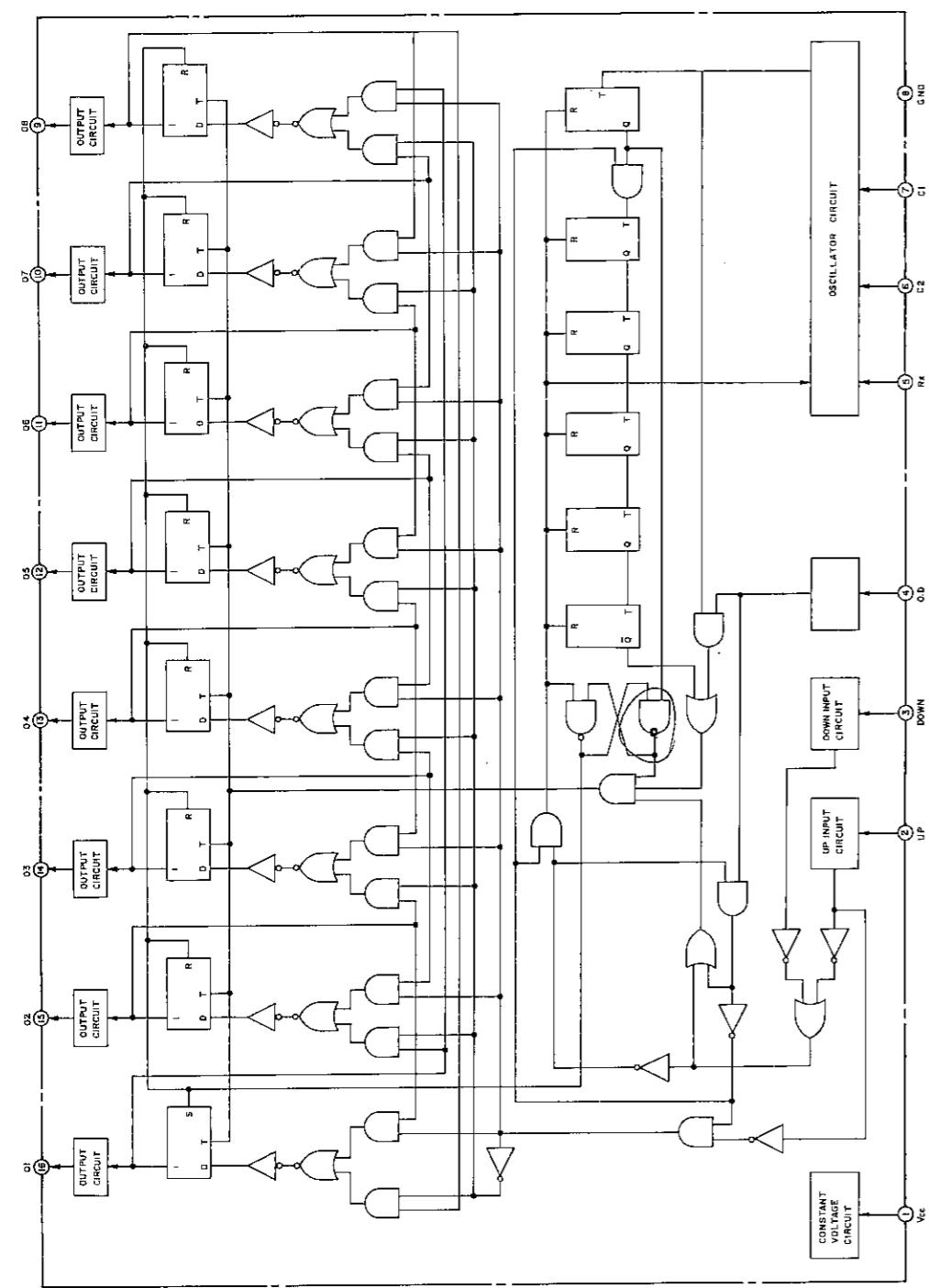


Figure 45 EQUIVALENT OF INTEGRATED CIRCUIT (IC201)

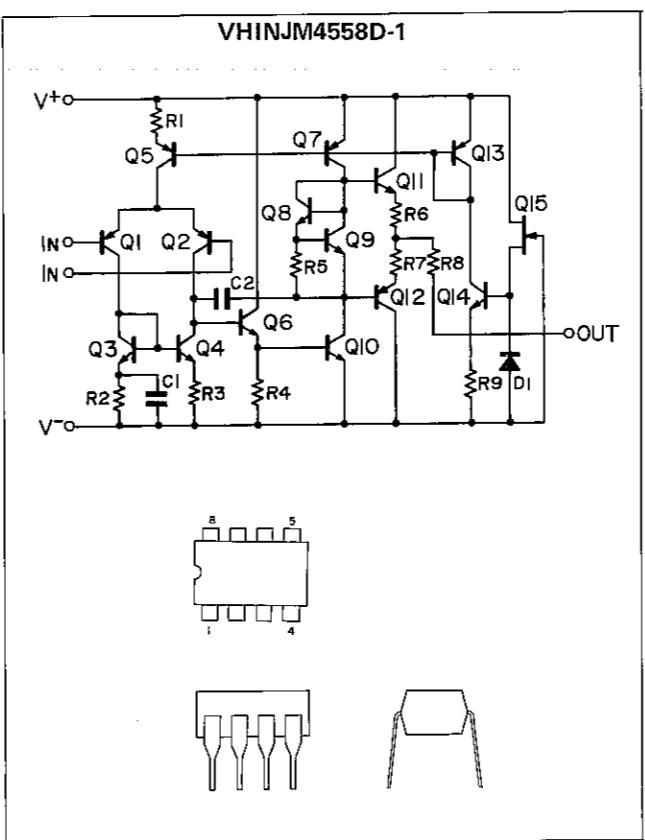
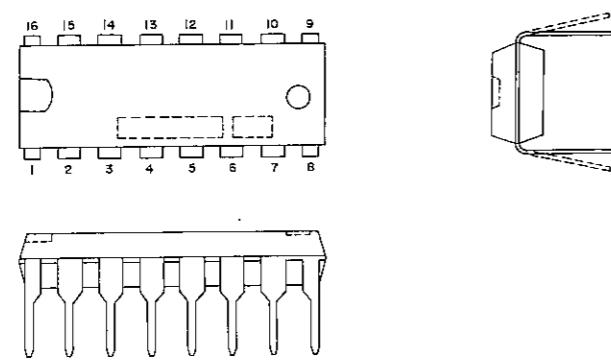


Figure 46 EQUIVALENT OF INTEGRATED CIRCUIT (IC1, 2, 202)

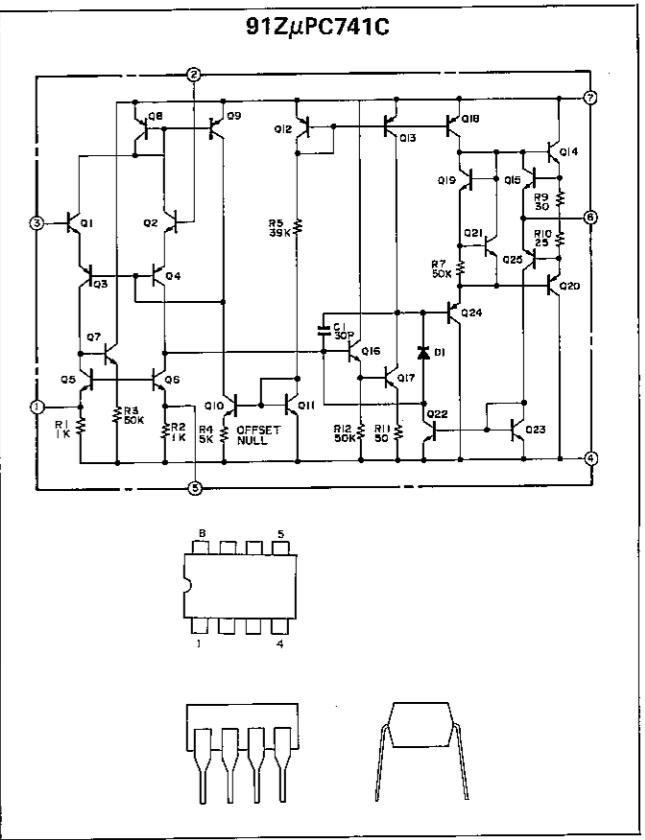


Figure 47 EQUIVALENT OF INTEGRATED CIRCUIT (IC301)

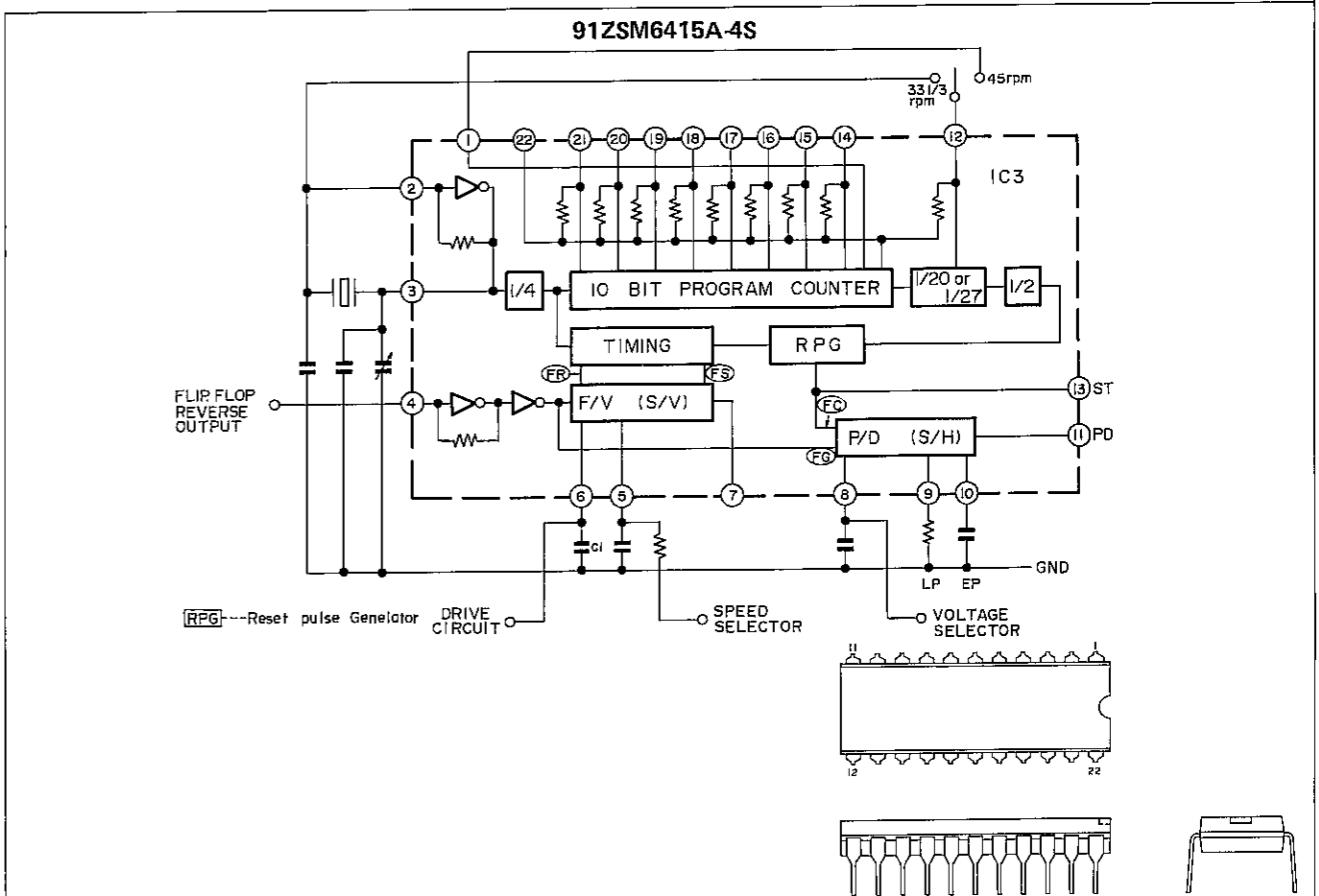
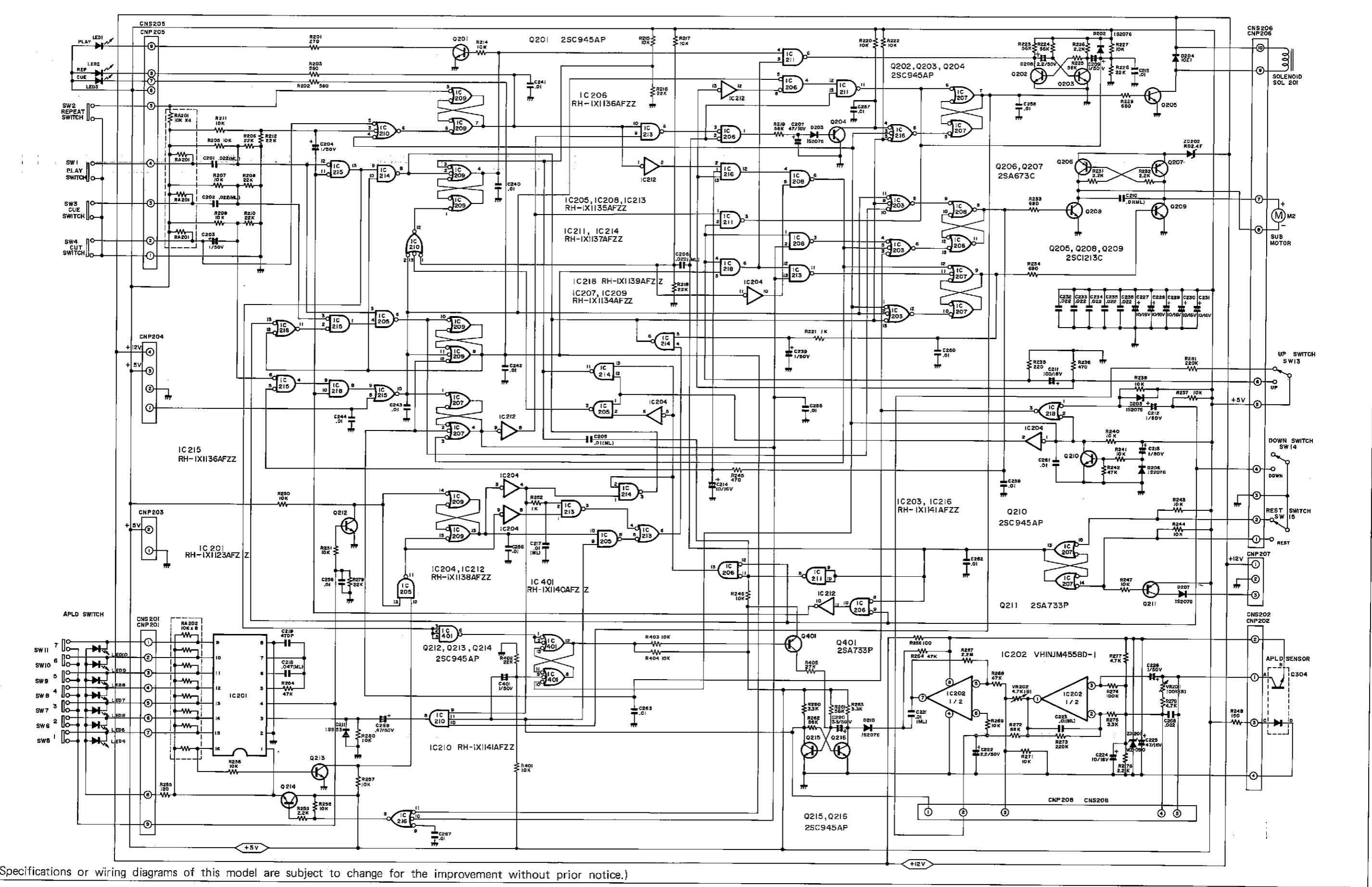
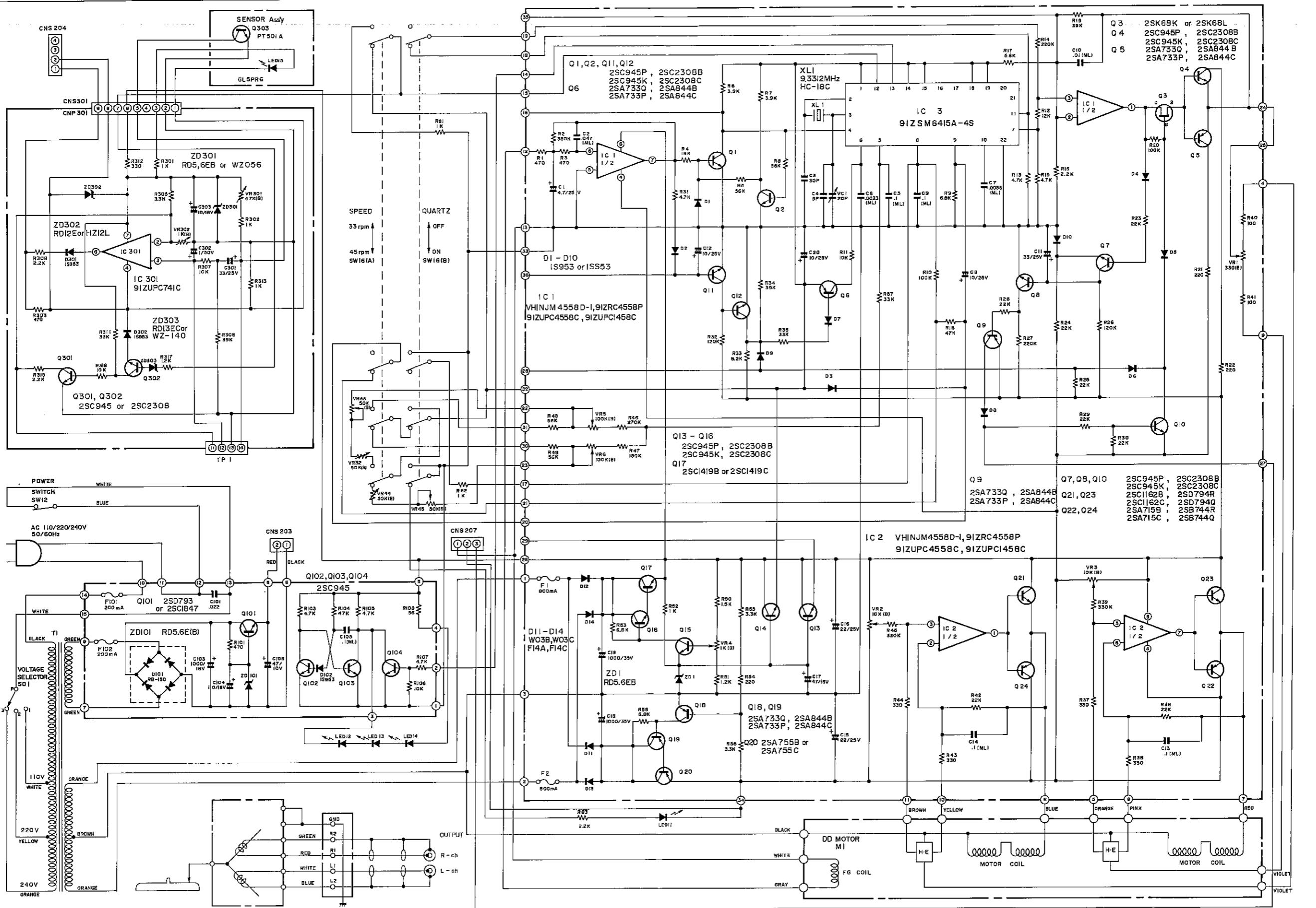


Figure 48 BLOCK DIAGRAM OF INTEGRATED CIRCUIT (IC3)



(Specifications or wiring diagrams of this model are subject to change for the improvement without prior notice.)

Figure 49 SCHEMATIC DIAGRAM OF LOGICAL CIRCUIT



(Specifications or wiring diagrams of this model are subject to change for the improvement without prior notice.)

Figure 50 SCHEMATIC DIAGRAM OF CONTROL CIRCUIT

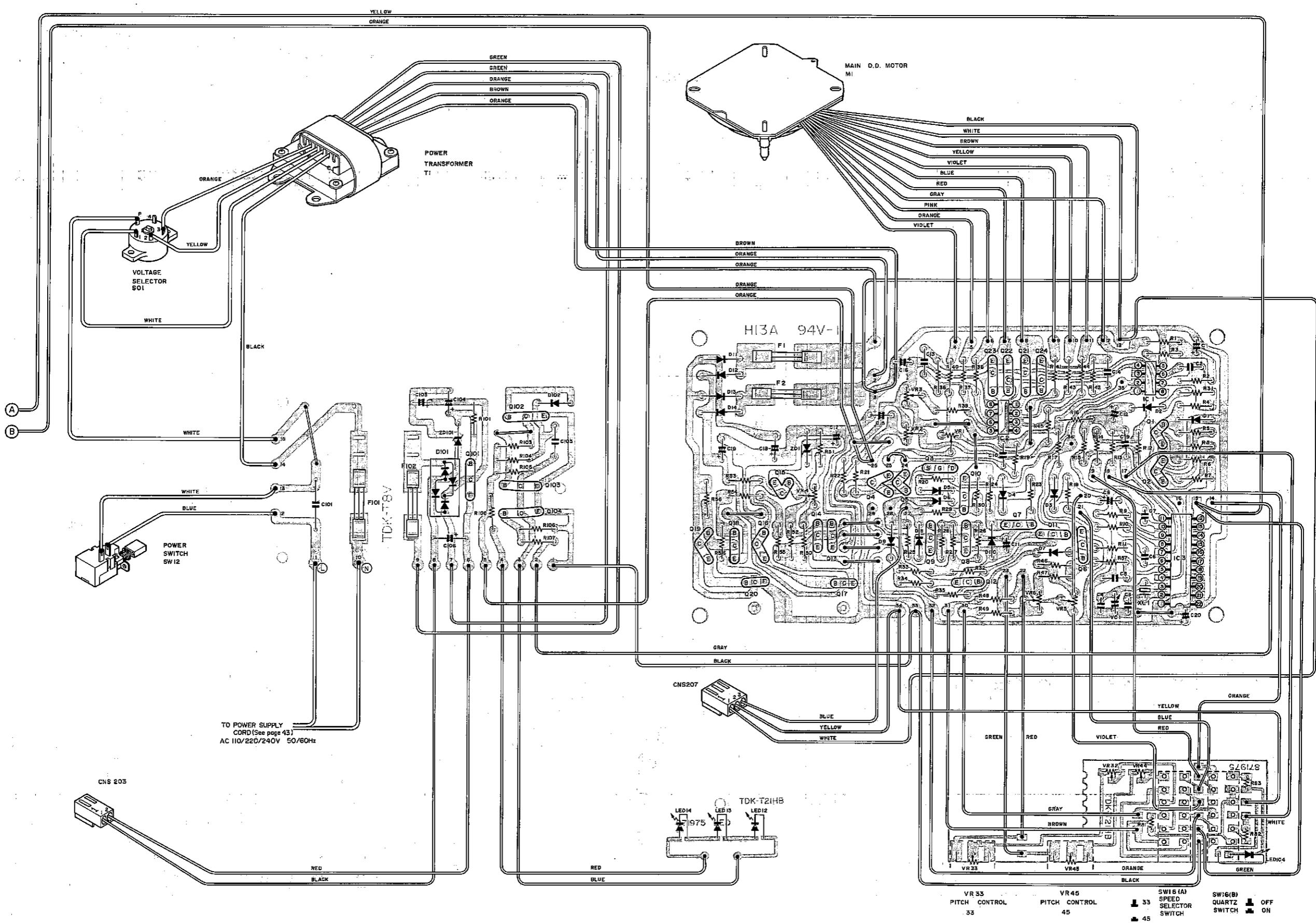


Figure 51 WIRING SIDE OF P.W.BOARD

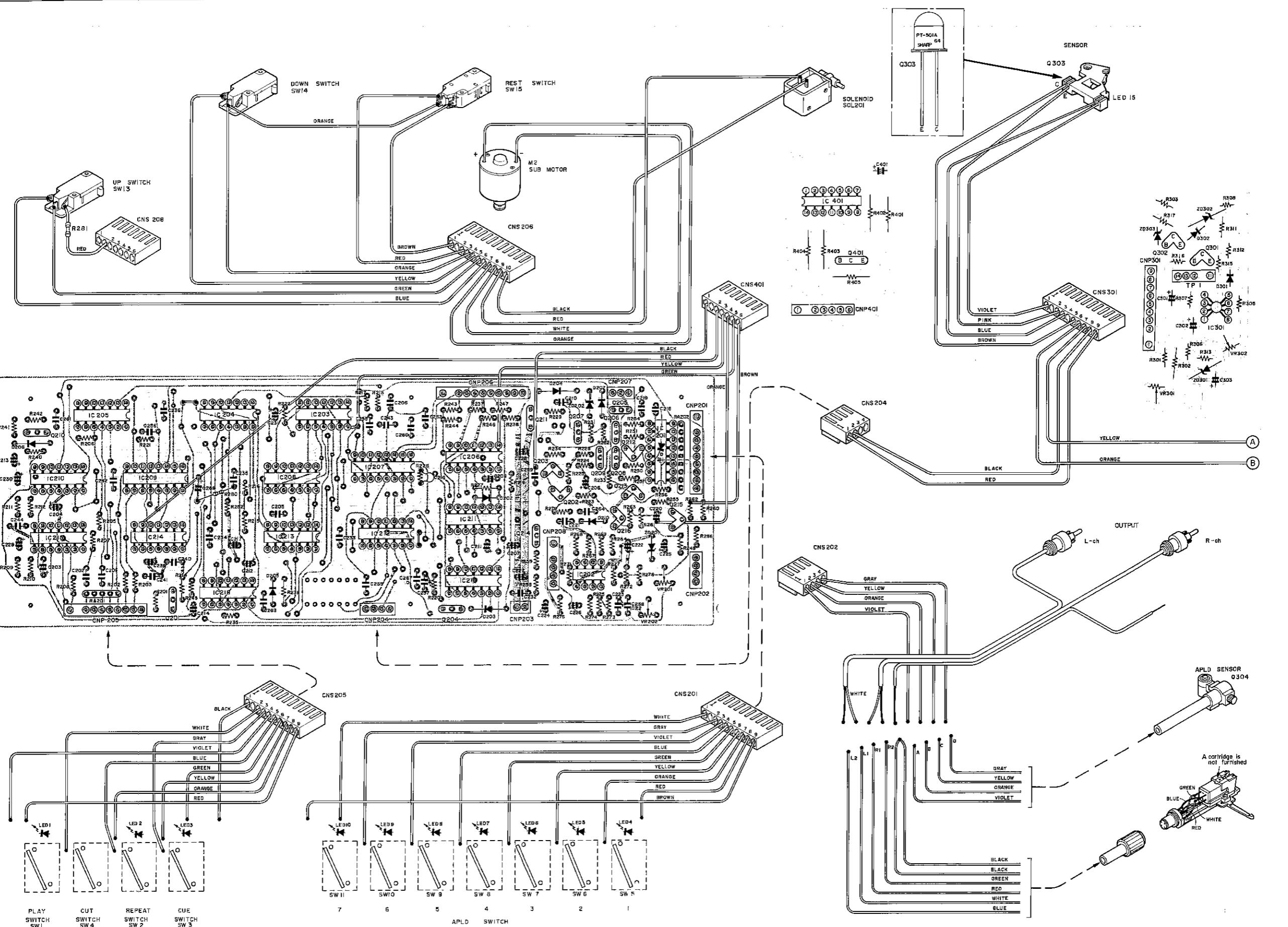


Figure 52 WIRING SIDE OF P.W.BOARD

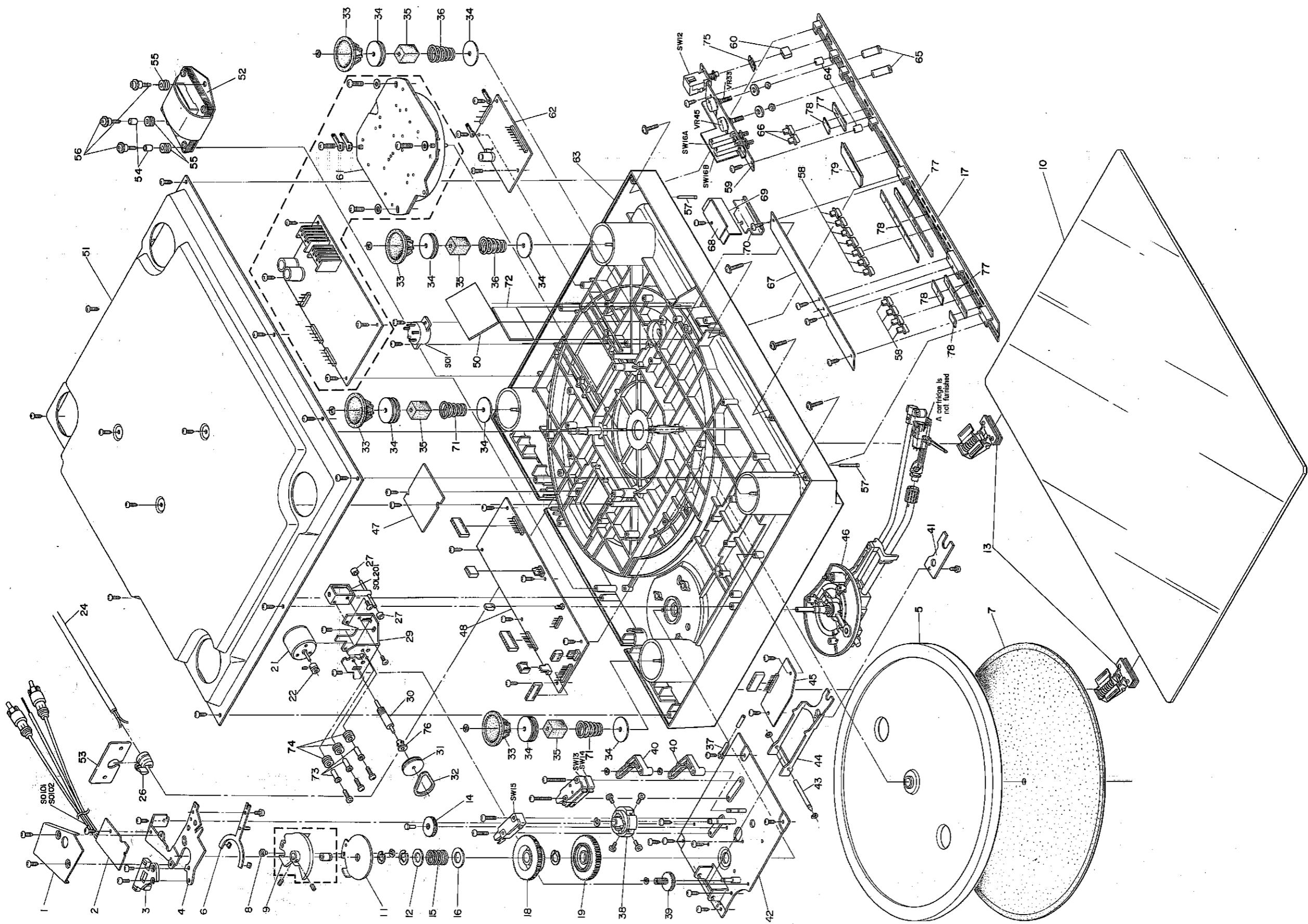


Figure 53 CABINET EXPLODED VIEW

# REPLACEMENT PARTS LIST

## **PARTS LIST**

## **"HOW TO ORDER REPLACEMENT PARTS"**

REF. NO.	PART NO.	DESCRIPTION	CODE	REF. NO.	PART NO.	DESCRIPTION	CODE
<b>INTEGRATED CIRCUITS</b>							
IC1	VHINJM4558D-1	Operation Amplifier	AH	Q6	91Z2SA733Q	Drive (2SA733Q, 2SA733P, 2SA844B, 2SA844C)	AE
	91ZRC4558P	(INJM4558D, RC4558P,		Q7	91Z2SA733P		
	91Z $\mu$ PC4558C	$\mu$ PC4558C, $\mu$ PC1458C)			91Z2SA844B		
	91Z $\mu$ PC1458C				91Z2SA844C		
IC2	VHINJM4558D-1	Operation Amplifier	AH		91Z2SC945P	Reverse Rotation Detector (2SC945P, 2SC945K, 2SC2308C, 2SC2308B)	AD
	91ZRC4558P	(INJM4558D, RC4558P,			91Z2SC945K		
	91Z $\mu$ PC4558C	$\mu$ PC4558C, $\mu$ PC1458C)			91Z2SC2308C		
	91Z $\mu$ PC1458C				91Z2SC2308B		
IC3	91ZSM6415A-4S	PLL IC (SM-6415A-4S)	AQ		91Z2SC2308B		
IC201	RH-IX1123AFZZ	Shift Register (M54832P)	AT		91Z2SA733Q	Reverse Rotation Detector (2SA733Q, 2SA733P, 2SA844B, 2SA844C)	AE
IC202	VHINJM4558D-1	Operation Amplifier (INJM4558D)	AH	Q9	91Z2SA733P		
IC203	RH-IX1141AFZZ	3 AND (SN74LS11)	AE		91Z2SA844B		
IC204	RH-IX1138AFZZ	Hex Inverter (SN74LS04)	AE		91Z2SA844C		
IC205	RH-IX1135AFZZ	4 NAND (SN74LS00)	AE	Q10	91Z2SC945P	Reverse Rotation Detector (2SC945P, 2SC945K, 2SC2308C, 2SC2308B)	AD
IC206	RH-IX1136AFZZ	4 NOR (SN74LS02)	AE		91Z2SC945K		
IC207	RH-IX1134AFZZ	S-R Latches (SN74279)	AH		91Z2SC2308C		
IC208	RH-IX1135AFZZ	4 NAND (SN74LS00)	AE		91Z2SC2308B		
IC209	RH-IX1134AFZZ	S-R Latches (SN74279)	AH	Q11	91Z2SC945P	Driver (2SC945P, 2SC945K, 2SC2308C, 2SC2308B)	AD
IC210	RH-IX1141AFZZ	3 AND (SN74LS11)	AE		91Z2SC945K		
IC211	RH-IX1137AFZZ	4 NAND (SN74LS03)	AE		91Z2SC2308C		
IC212	RH-IX1138AFZZ	Hex Inverter (SN74LS04)	AE		91Z2SC2308B		
IC213	RH-IX1135AFZZ	4 NAND (SN74LS00)	AE	Q12	91Z2SC945P	Driver (2SC945P, 2SC945K, 2SC2308C, 2SC2308B)	AD
IC214	RH-IX1137AFZZ	4 NAND (SN74LS03)	AE		91Z2SC945K		
IC215	RH-IX1136AFZZ	4 NOR (SN74LS02)	AE		91Z2SC2308C		
IC216	RH-IX1141AFZZ	3 AND (SN74LS11)	AE		91Z2SC2308B		
IC218	RH-IX1139AFZZ	4 AND (SN74LS08)	AE	Q13	91Z2SC945P	Constant Voltage (2SC945P, 2SC945K, 2SC2308C, 2SC2308B)	AD
IC301	91Z $\mu$ PC741C	Operation Amplifier ( $\mu$ PC741C)	AQ		91Z2SC945K		
IC401	RH-IX1140AFZZ	3 NAND (SN74LS10)	AE	Q14	91Z2SC2308C		
<b>TRANSISTORS</b>							
Q1	91Z2SC945P	Flip-Flop (2SC945P, 2SC945K, 2SC2308C, 2SC2308B)	AD	Q15	91Z2SC945K	Constant Voltage (2SC945P, 2SC945K, 2SC2308C, 2SC2308B)	AD
	91Z2SC945K				91Z2SC2308C		
	91Z2SC2308C				91Z2SC2308B		
	91Z2SC2308B				91Z2SC945P	Constant Voltage (2SC945P, 2SC945K, 2SC2308C, 2SC2308B)	
Q2	91Z2SC945P	Flip-Flop (2SC945P, 2SC945K, 2SC2308C, 2SC2308B)	AD	Q16	91Z2SC945K	Constant Voltage (2SC945P, 2SC945K, 2SC2308C, 2SC2308B)	AD
	91Z2SC945K				91Z2SC2308C		
	91Z2SC2308C				91Z2SC2308B		
	91Z2SC2308B				91Z2SC945P	Constant Voltage (2SC945P, 2SC945K, 2SC2308C, 2SC2308B)	
Q3	91Z2SK68K	FET, Voltage Switching (2SK68K, 2SK68L)	AF	Q17	91Z2SC1419B	Constant Voltage (2SC1419B, 2SC1419C)	AG
	91Z2SK68L				91Z2SC1419C		
	91Z2SC945P	Position Detect (2SC945P, 2SC945K, 2SC2308C, 2SC2308B)		Q18	91Z2SA733Q	Constant Voltage (2SA733Q, 2SA733P, 2SA844B, 2SA844C)	
	91Z2SC945K				91Z2SA733P		
Q4	91Z2SC2308C		AD		91Z2SA844B		AE
	91Z2SC2308B				91Z2SA844C		
	91Z2SA733Q	Position Detect (2SA733Q, 2SA733P, 2SA844B, 2SA844C)		Q19	91Z2SA733Q	Constant Voltage (2SA733Q, 2SA733P, 2SA844B, 2SA844C)	
	91Z2SA733P				91Z2SA733P		
Q5	91Z2SA844B		AE		91Z2SA844B		AE
	91Z2SA844C				91Z2SA844C		
	91Z2SA844C				91Z2SA755B	Constant Voltage (2SA755B, 2SA755C)	
	91Z2SA844C				91Z2SA755C		

REF. NO.	PART NO.	DESCRIPTION	CODE	REF. NO.	PART NO.	DESCRIPTION	CODE
Q21	91Z2SC1162B	Motor Drive (2SC1162B, 2SC1162C, 2SD794R, 2SD794Q)	AG	D9	91Z1S953	Starter (1S953, 1SS53)	AC
	91Z2SC1162C			D10	91Z1SS53	Reverse Detector (1S953, 1SS53)	AC
	91Z2SD794R				91Z1S953		
	91Z2SD794Q				91Z1SS53		
Q22	91Z2SA715B	Motor Drive (2SA715B, 2SA715C, 2SB744R, 2SB744Q)	AG	D11	91ZW03B	Rectifier (W03B, W03C, F14A, F14C)	AE
	91Z2SA715C				91ZW03C		
	91Z2SB744R				91ZF14A		
	91Z2SB744Q				91ZF14C		
Q23	91Z2SC1162B	Motor Drive (2SC1162B, 2SC1162C, 2SD794R, 2SD794Q)	AG	D12	91ZW03B	Rectifier (W03B, W03C, F14A, F14C)	AE
	91Z2SC1162C				91ZW03C		
	91Z2SD794R				91ZF14A		
	91Z2SD794Q				91ZF14C		
Q24	91Z2SA715B	Motor Drive (2SA715B, 2SA715C, 2SB744R, 2SB744Q)	AG	D13	91ZW03B	Rectifier (W03B, W03C, F14A, F14C)	AE
	91Z2SA715C				91ZW03C		
	91Z2SB744R				91ZF14A		
	91Z2SB744Q				91ZF14C		
Q101	91Z2SD793	Regulator (2SD793, 2SC1847)	AG	D14	91ZW03B	Rectifier (W03B, W03C, F14A, F14C)	AE
	91Z2SC1847				91ZW03C		
Q102	91Z2SC945	Flip-Flop (2SC945)	AD		91ZF14A		
Q103	91Z2SC945	Flip-Flop (2SC945)	AD		91ZF14C		
Q104	91Z2SC945	Switching (2SC945)	AD	D101	91ZRB-150	Rectifier (RB-150)	AG
Q201	91Z2SC945AP	Switching (Play Indicator) (2SC945AP)	AD	D102	91Z1S953	Level Shift (1S953)	AC
Q202	91Z2SC945AP	Flip-Flop (2SC945AP)	AD	D202	91Z1S2076	Protector (1S2076)	AC
Q203	91Z2SC945AP	Flip-Flop (2SC945AP)	AD	D203	91Z1S2076	Timer (1S2076)	AC
Q204	91Z2SC945AP	Timer (2SC945AP)	AD	D204	91Z10E1	Protector (10E1)	AC
Q205	91Z2SC1213C	Solenoid Drive (2SC1213C)	AG	D205	91Z1S2076	Protector (1S2076)	AC
Q206	91Z2SA673C	Sub Motor Drive (2SA673C)	AG	D206	91Z1S2076	Discharger (1S2076)	AC
Q207	91Z2SA673C	Sub Motor Drive (2SA673C)	AG	D207	91Z1S2076	DD Motor Drive (1S2076)	AC
Q208	91Z2SC1213C	Sub Motor Drive (2SC1213C)	AG	D210	91Z1S2076	Protector (1S2076)	AC
Q209	91Z2SC1213C	Sub Motor Drive (2SC1213C)	AG	D211	91Z1S953	Protector (1S953)	AC
Q210	91Z2SC945AP	Flip-Flop Reset (2SC945AP)	AD	D301	91Z1S953	Level Shift (1S953)	AC
Q211	91Z2SA733P	D.D. Motor Drive (2SA733P)	AE	D302	91Z1S953	Protector (1S953)	AC
Q212	91Z2SC945AP	Switching (2SC945AP)	AD				
Q213	91Z2SC945AP	Switching (2SC945AP)	AD				
Q214	91Z2SC945AP	Switching (2SC945AP)	AD				
Q215	91Z2SC945AP	Flip-Flop (2SC945AP)	AD	ZD1	91ZRD5.6EB	Regulator (RD5.6EB)	AG
Q216	91Z2SC945AP	Flip-Flop (2SC945AP)	AD	ZD101	91ZRD5.6EB	Regulator (RD5.6EB)	AG
Q301	91Z2SC945	Speed Selector (2SC945, 2SC2308)	AD	ZD201	91ZWZ-090	Regulator (WZ-090)	AG
	91Z2SC2308			ZD202	91ZRD2.4F	Level Shift (RD2.4F)	AF
Q302	91Z2SC945	Speed Selector (2SC945, 2SC2308)	AD	ZD301	91ZWZ-056	Regulator (WZ-056, RD5.6EB)	AG
	91Z2SC2308				91ZRD5.6EB		
Q303	VHPPT-501A/-1	Photo Transistor (PT-501A)	AR	ZD302	91ZRD12E	Regulator (RD12E, HZ12L)	AG
	RH-PX1014AFZZ	APLD Sensor (GP-453)			91ZH21L		
Q401	91Z2SA733P	Switching (2SA733P)	AE	ZD303	91ZRD13EC	Regulator (RD13EC, WZ-140)	AG
					91ZWZ-140		
<b>ZENER DIODES</b>							
<b>DIODES</b>							
<b>LED (Light Emitting Diode)</b>							
D1	91Z1S953	Regulator (1S953, 1SS53)	AC	LED1	VHPGL-9NG12-1	Play Indicator (GL-9NG12)	AD
	91Z1SS53			LED2	RH-PX1008AFZZ	Repeat Indicator (GL-9PR2)	AE
D2	91Z1S953	Regulator (1S953, 1SS53)	AC	LED3	RH-PX1008AFZZ	Cue Indicator (GL-9PR2)	AE
	91Z1SS53			LED4	VHPGL-9NG12-1	APLD Number Indicator (GL-9NG12)	AD
D3	91Z1S953	Starter (1S953, 1SS53)	AC	LED5	VHPGL-9NG12-1	APLD Number Indicator (GL-9NG12)	AD
	91Z1SS53	Reverse Detector (1S953, 1SS53)		LED6	VHPGL-9NG12-1	APLD Number Indicator (GL-9NG12)	AD
D4	91Z1S953	Reverse Detector (1S953, 1SS53)	AC	LED7	VHPGL-9NG12-1	APLD Number Indicator (GL-9NG12)	AD
	91Z1SS53			LED8	VHPGL-9NG12-1	APLD Number Indicator (GL-9NG12)	AD
D5	91Z1S953	Reverse Detector (1S953, 1SS53)	AC	LED9	VHPGL-9NG12-1	APLD Number Indicator (GL-9NG12)	AD
	91Z1SS53						
D6	91Z1S953	Reverse Detector (1S953, 1SS53)	AC				
	91Z1SS53						
D7	91Z1S953	Starter (1S953, 1SS53)	AC				
	91Z1SS53	Reverse Detector (1S953, 1SS53)		LED9	VHPGL-9NG12-1	APLD Number Indicator (GL-9NG12)	AD
D8	91Z1S953		AC				
	91Z1SS53						

# PARTS LIST

## **PARTS LIST**

\*\*; Price will be quoted upon receipt of order.

## **PARTS LIST**

## **PARTS LIST**

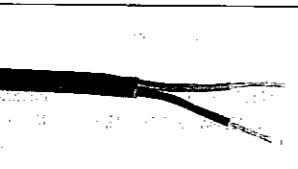
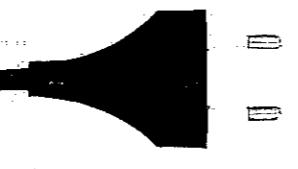
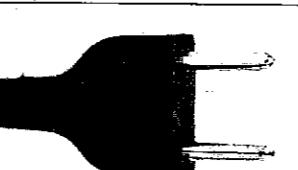
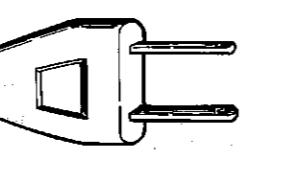
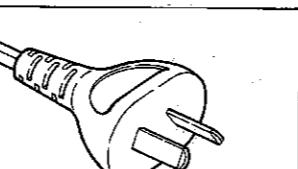
AC supply cord	Bushing	Connection		Photograph of figure
		(L)	(N)	
QACCB0054AF09	LBSHC0002AGZZ	Brown	Blue	
QACCV0001AGZZ	LBSHC0004AGZZ	Brown	Blue	
QACCZ0053AF00	LBSHC0003AGZZ	Black	Black	
QACCZ0002TA0F	LBSHC0003AGZZ	Brown	Brown	
91Z897322	LBSHC0003AGZZ	Black	Black	

Figure 54 AC SUPPLY CORD WIRING CONNECTION